CALIFORNIA HIGH-SPEED TRAIN

Project Environmental Impact Report/Environmental Impact Statement

PRELIMINARY

Alternatives Analysis Report

for the

San Francisco to San Jose Section

April 2010

California High-Speed Rail Authority

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U.S. Department of Transportation
Federal Railroad Administration

California High-Speed Train Project

San Francisco to San Jose Section Project EIR/EIS

PRELIMINARY ALTERNATIVES ANALYSIS REPORT

Public Comment on Preliminary Alternatives Analysis Report

Comments should be directed to:

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Attn: San Francisco to San Jose Section Preliminary Alternatives Analysis Report Comments

Comments can be received by the Authority through regular U.S. mail, via email with the subject line “San Francisco to San Jose Section Preliminary Alternatives Analysis Report Comments” sent to comments@hsr.ca.gov, or by facsimile transmission to (916) 322-0827.

TABLE OF CONTENTS

FIGURES

TABLES

ABBREVIATIONS / ACRONYMS

AA.....ALTERNATIVE ANALYSIS
AASHTO.....AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
ACE.....ALTAMONT COMMUTER EXPRESS
AMTRAK .....NATIONAL RAILROAD PASSENGER CORPORATION
AUTHORITY .....CALIFORNIA HIGH-SPEED RAIL AUTHORITY
BATA.....BAY AREA TOLL AUTHORITY
BNSF.....BURLINGTON NORTHERN SANTA FE
CALTRAIN.....PENINSULA CORRIDORS JOINT POWERS BOARD
CALTRANS .....CALIFORNIA DEPARTMENT OF TRANSPORTATION
CAPITOLS.....CAPITOL CORRIDOR JOINT POWERS BOARD
CEQA.....CALIFORNIA ENVIRONMENTAL QUALITY ACT
CHRIS .....CALIFORNIA HISTORICAL RESOURCES INFORMATION SYSTEM
CNG .....COMPRESSED NATURAL GAS
CSS.....CONTEXT SENSITIVE SOLUTIONS
EIR .....ENVIRONMENTAL IMPACT REPORT
EIS.....ENVIRONMENTAL IMPACT STATEMENT
EMU.....ELECTRIC MULTIPLE UNITS
FHWA.....FEDERAL HIGHWAY ADMINISTRATION
FRA.....FEDERAL RAILROAD ADMINISTRATION
FTA.....FEDERAL TRANSIT ADMINISTRATION
GIS .....GEOGRAPHIC INFORMATION SYSTEM
GPS .....GLOBAL POSITIONING SYSTEM
HOT.....HIGH-OCCUPANCY TOLL
HOV .....HIGH OCCUPANCY VEHICLE
HST.....HIGH-SPEED TRAIN
I .....INTERSTATE ROUTE
KOP.....KEY OBSERVATION POINT
LOS.....LEVEL OF SERVICE
LRT.....LIGHT RAIL TRANSIT
MOA.....MEMORANDUM OF AGREEMENT
MP .....MILE POST
MPH .....MILES PER HOUR
MT2.....MAIN TRACK #2
MTC .....METROPOLITAN TRANSPORTATION COMMISSION
MUNI.....SAN FRANCISCO MUNICIPAL TRANSPORTATION
NEPA.....NATIONAL ENVIRONMENTAL POLICY ACT
NRHP.....NATIONAL REGISTER OF HISTORIC PLACES
PCJPB.....PENINSULA CORRIDOR JOINT POWERS BOARD (CALTRAIN)
PMT.....PROGRAM MANAGEMENT TEAM
PWG.....POLICYMAKER WORKING GROUP
ROW .....RIGHT-OF-WAY
RRC .....REGIONAL REBUILD CENTER
RTP .....REGIONAL TRANSPORTATION PLAN
SAMTRANS.....SAN MATEO COUNTY TRANSIT DISTRICT
SECTION 4(f) .....SECTION 4(f) OF THE U.S. DEPARTMENT OF TRANSPORATION ACT OF 1966
SFO.....SAN FRANCISCO INTERNATIONAL AIRPORT
SJC.....MINETA SAN JOSE INTERNATIONAL AIRPORT
SJRRC.....SAN JOAQUIN REGIONAL RAIL COMMISSION
SR.....STATE ROUTE
STIP.....STATE TRANSPORTATION IMPROVEMENT PROGRAM
TCE.....TEMPORARY CONSTRUCTION EASEMENT
TJPA.....TRANSBAY JOINT POWERS AUTHORITY
TOD .....TRANSIT-ORIENTED DEVELOPMENT
TOR .....TOP OF RAIL
TTC.....TRANSBAY TRANSIT CENTER
TWG.....TECHNICAL WORKING GROUP
UP.....UNION PACIFIC RAILROAD
USGS.....UNITED STATES GEOLOGICAL SURVEY
VTA.....SANTA CLARA VALLEY TRANSPORTATION AUTHORITY
YOR.....YEAR OF EXPENDITURE

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Summary

S.1 Results from the Preliminary Alternatives Analysis

The Preliminary Alternatives Analysis report and its associated engineering and environmental analysis confirms that a four track, grade separated, shared Caltrain and High-Speed Train (HST) system is feasible and the preferred HST alternative between San Francisco and San Jose on the Peninsula (see Figure S-1). It also confirms that such a system between San Francisco and San Jose can be built at costs that are in the range of what has been presented in the 2009 Business Plan and in previous Program Level environmental documents.

Since 1996, the Peninsula Corridor Joint Powers Board (PCJPB or Caltrain) has endorsed HST in concept and has adopted multiple resolutions expressing such support. Since 2004, the PCJPB and the California High Speed Rail Authority (Authority) have worked in a partnership to develop the Caltrain corridor into a 21st century railroad capable of serving both commuter and HST for the Peninsula and California. This partnership is founded on the basis that there are considerable efficiencies and synergies between the two rail services. This alignment alternative would increase intercity connectivity and accessibility to San Francisco, the Peninsula, and SFO, while improving the safety, reliability, and performance of the regional Caltrain commuter service. The Caltrain corridor shared-use option would take advantage of the existing rail infrastructure and would maximize the opportunity to provide rail service at-grade where possible. Environmental impacts would be minimized since this alignment utilizes the existing Caltrain right-of-way. In addition, the Caltrain shared use corridor would provide safety and traffic benefits by grade-separating existing at-grade roadway crossings. For these reasons, the Caltrain shared use corridor is the preferred alignment for HST service between San Francisco and San Jose.

The entire alignment will be a predominantly four track, grade separated railroad and would allow both Caltrain and HST to operate their respective services. It would be a shared track system with HST operating at speeds up to 125 mph and Caltrain up to 110 mph.

The HST stations recommended for continued study are:

Downtown San Francisco: A joint terminal solution for downtown San Francisco at the Transbay Transit Center and 4th and King.

San Francisco Airport Connector Station: Millbrae (SFO).

A Potential Mid-Peninsula Station: Redwood City, Palo Alto and Mountain View Caltrain stations are currently under consideration. One or none of these potential station locations could be selected to be part of the HST system.

Downtown San Jose Terminus: Diridon Station.

The Authority, the FRA and Caltrain, in addition to performing engineering and environmental analysis, have engaged the public and the communities on the Peninsula and are incorporating their input from San Francisco to San Jose. The observations below outline some of the highlights from the work and input received to-date:

- In San Francisco the analysis supports focusing Authority, FRA and Caltrain engineering and study efforts on a joint terminal solution for downtown San Francisco at the Transbay Transit Center and 4th and King. This is consistent with the City and County of San Francisco's and the Transbay Joint Powers Authority's plans and policies, and is a workable solution for the HST and Caltrain services.
- On the Peninsula, the Authority, FRA and Caltrain will limit the use of high berms in commercial or residential areas where they would significantly reduce connectivity and mobility or where there is strong local opposition to this type of structure.
- Tunnel options for Caltrain, HST or both have been added for further evaluation in sections throughout the corridor. This was, in some cases, in direct response to suggestions from local communities.
- At the request of the City of Mountain View, the Authority is considering the current Caltrain Mountain View station as an additional potential HST station.

For the detailed evaluation of alternatives, the three basic vertical options of elevated, at-grade and below grade have been expanded to six options to better differentiate their characteristics.

- Aerial Viaduct
- Berm or Mechanically Stabilized Earth (MSE)
- At-Grade (Existing Caltrain Grade)
- Open Trench
- Covered Trench/Tunnel
- Deep Tunnel

Table S-1 and Figure S-2 present the alternatives preliminarily identified to be carried forward for further engineering and environmental analysis. Additional outreach will occur as these preliminary recommendations are finalized and carried forward into further environmental and engineering analysis. It is important to understand that while some subsections carry multiple design options it is not always possible to connect two vertical options from one subsection to another (tunnel to aerial viaduct for example). In some cases communities on the corridor will need to "share" an alternative. The transitions from one vertical solution to another takes approximately 3,000' or just over half a mile, so "quick" adjustments between vertical alternatives are not possible. These types of engineering realities will necessitate close cooperation between neighboring cities and communities, Caltrain and the Authority in developing appropriate solutions in these subsections and throughout the corridor.

Given the highly developed nature of the Caltrain corridor, the Authority, FRA and Caltrain have carried a wide range of vertical design options, where practical, from San Francisco to San Jose. No design options on the Caltrain corridor were eliminated from further consideration due to cost alone. This was in part because many individuals and communities on the corridor expressed a strong desire that alternatives be carried forward until there was a thorough analysis and discussion of the costs, environmental impacts, and engineering issues of the various vertical options. The other primary reason is that in order to develop an appropriate and logical cost estimate, all of the 10 subsections of the Caltrain corridor need to be "stitched" together into a cohesive system from San Francisco to San Jose. This exercise will be part of the 15% design study which is currently underway. Context sensitive solutions will also be incorporated in this effort. Once these corridor-wide alternatives are developed, they will be described on an engineering, environmental and cost basis. These corridor-wide alternatives can then become the basis for discussion of cost sharing between the Authority, FRA and other agencies including cities on the corridor.

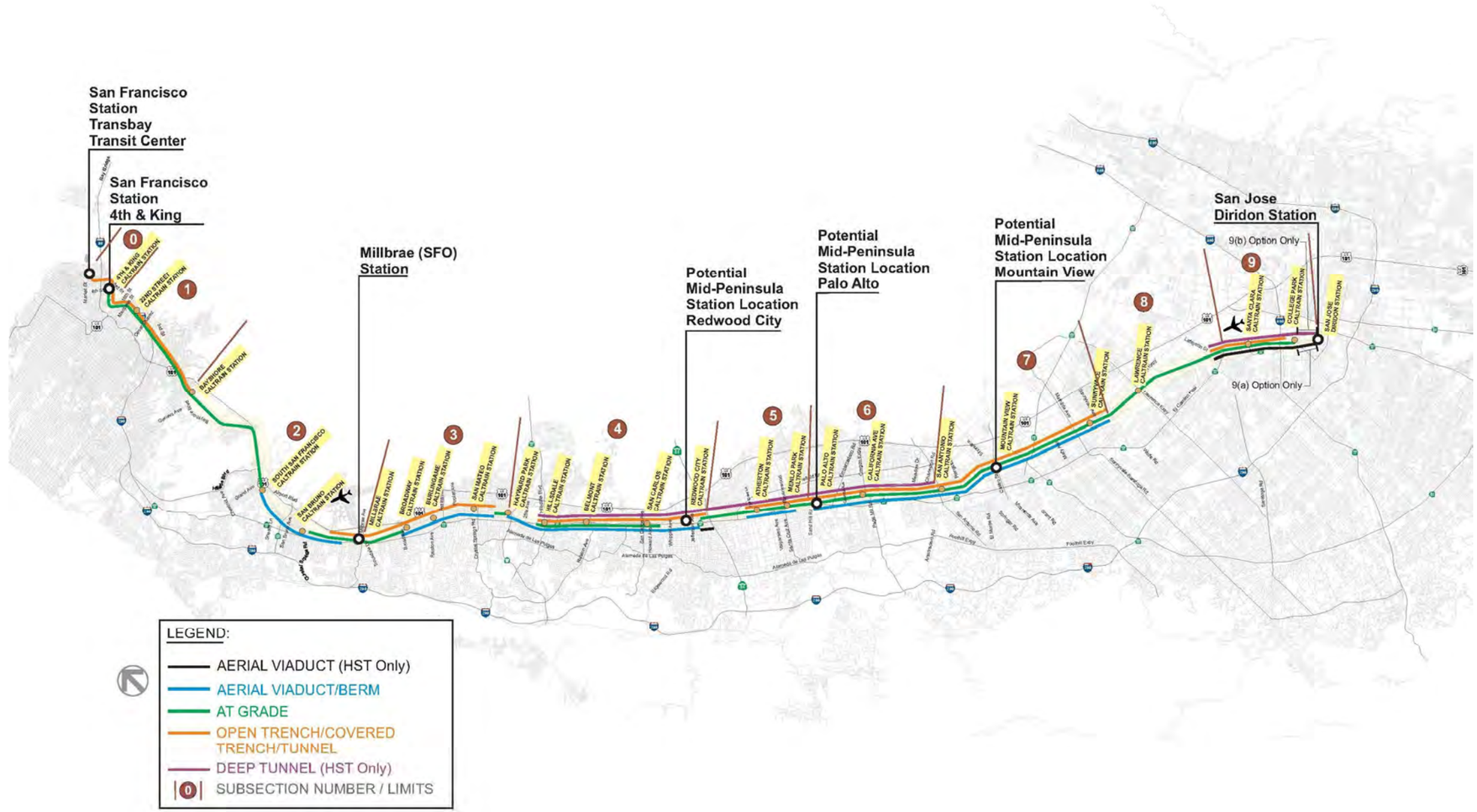
The Preliminary Alternatives Analysis report shows that if alternatives from San Francisco to San Jose were created from the most costly design options put together, the costs could be between four to five times what has been accounted for in the Business Plan or other previous estimates. Such high cost alternatives would be impracticable.

Table S-1
Alternatives Carried Forward

Sub-section	Location	Alternatives Carried Forward					
		Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/ Tunnel	Deep Tunnel
0(a)	HST and Caltrain to both Transbay and 4th & King					✓	
0(b)	HST and Caltrain to Transbay, Caltrain to 4th & King						
0(c)	HST to 4th & King, Caltrain to Transbay and 4th & King						
0(d)	HST and Caltrain to both Beale Street and 4th & King						
1A	North of Mission Bay Drive to South of 16th Street			✓		✓	
1B-1C	South of 16th Street to North of Cesar Chavez Street			✓		✓	
1D-1G	North of Cesar Chavez Street to South Portal Tunnel No. 4			✓		✓	
2A	South Portal Tunnel No. 4 to south of Colma Creek			✓			
2B	South of Colma Creek to south of I-380		✓				
2C	South of I-380 to south of Center Street	✓	✓	✓	HST Only	HST Only	
2D	South of Center Street to south of Millbrae Avenue			✓	HST Only	HST Only	
3A	South of Millbrae Avenue to south of Mills Creek	✓		✓	✓	✓	
3B	South of Mills Creek to north of Villa Terrace	✓			✓	✓	
3C-3D	North of Villa Terrace to north of Hayward Park Station	✓			✓	✓	
3E	North of Hayward Park Station to north of Highway 92			✓			
4A	North of Highway 92 to south of 25th Avenue		✓				
4B	South of 25th Avenue to south of Cordilleras Creek	✓	✓	✓		✓	HST Only
4C	South of Cordilleras Creek to north of Woodside Road	✓			✓	✓	HST Only
4D	North of Woodside Road to north of 5th Avenue	HST Only		Caltrain Only	HST Only	HST Only	HST Only
5A	North of 5th Avenue to south of 5th Avenue			✓			HST Only
5B	South of 5th Avenue to south of Ravenswood Avenue	✓		✓	✓	✓	HST Only
5C	South of Ravenswood Avenue to north of San Mateo County/Santa Clara County Line			✓		✓	HST Only
6A	North of San Mateo County/Santa Clara County Line to south of Embarcadero Road			✓		✓	HST Only
6B	South of Embarcadero Road to south of Churchill Avenue	✓		✓	✓	✓	HST Only
6C	South of Churchill Avenue to north of East Meadow Drive	✓		✓	✓	✓	HST Only
6D	North of East Meadow Drive to north of Adobe Creek	✓		✓	✓	✓	HST Only
7A-7B	North of Adobe Creek to north of Stevens Creek	✓		✓	✓	✓	
7C-7D	North of Stevens Creek to north of Fair Oaks Avenue	✓		✓	✓	✓	
8A	North of Fair Oaks Avenue to south of Scott Boulevard			✓			
8B	South of Scott Boulevard to north of De La Cruz Boulevard	HST Only		HST Only		HST Only	HST Only
9(a)A	North of De La Cruz Boulevard to South of Taylor Street	HST Only		HST Only		HST Only	HST Only
9(a)B	South of Taylor Street to Diridon Station	HST Only					
9(b)A	North of De La Cruz Boulevard to South of Taylor Street						HST Only
9(b)B	South Taylor Street to Diridon Station						HST Only

Figure S-1
HST Caltrain Shared Use Corridor

Figure S-2
Alternatives Carried Forward



S.2 Next Steps

This Preliminary Alternatives Analysis report informs the Project Description for the EIR/EIS. It is also sets parameters for the next level of design (15%) and environmental analysis. This on-going work will provide the Authority, FRA, Caltrain and the communities on the corridor more details and a fuller picture of the both the design options in each subsection and a comprehensive vision of the entire corridor.

Detailed operations studies will be performed for combining the Caltrain and HST scheduled operations for the corridor so that the design and the phasing of the construction of the project will inform the feasibility of the various vertical alternatives.

As the engineering and environmental work continues, the Authority and Caltrain will continue to meet and engage the cities on the corridor in a discussion about the various alternatives. If deemed necessary by the lead agencies, a supplemental Alternative Analysis report will consider feedback received on this Preliminary Alternative Analysis report and will discuss how the alternatives analysis will inform the detailed engineering, environmental and outreach activities on the Caltrain Corridor. These activities will inform preparation of the draft EIR/EIS, which is currently scheduled for public comment in December of 2010.

1.0 Introduction

The California High-Speed Rail Authority (the Authority) is studying alternative alignments and design options for a high-speed train (HST) section between San Francisco and San Jose. This report documents the evaluation of the design options and identifies feasible and practicable alternatives to carry forward for environmental review and evaluation in the San Francisco to San Jose HST Project Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) to be prepared in compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA).

1.1 California HST Project Background

The California HST is planned to provide intercity, high-speed service on more than 800 miles of tracks throughout California, connecting the major population centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego. The HST system is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology, which will include contemporary safety, signaling, and automated train-control systems. The trains will be capable of operating at speeds of up to 220 miles per hour (mph) over a fully grade-separated, dedicated track alignment, with an expected express trip time between Los Angeles and San Francisco of approximately 2 hours and 40 minutes. In the section between San Francisco and San Jose, trains will not exceed the design speed of 125 mph and operate in a shared use corridor with Caltrain.

The California HST project will be planned, designed, constructed, and operated under the direction of the Authority, a state governing board formed in 1996. The Authority's statutory mandate is to develop a high-speed rail system that is coordinated with the state's existing transportation network, which includes intercity rail and bus lines, regional commuter rail lines, urban rail and bus transit lines, highways, and airports.

1.2 San Francisco to San Jose EIR/EIS Background

The San Francisco to San Jose HST Section is a critical link in Phase 1 of the HST System, which will provide service between San Francisco, Los Angeles and Anaheim. The Caltrain Corridor route of the San Francisco to San Jose Section was analyzed, evaluated and selected in the 2005 Final Program EIR/EIS for the Proposed California High-Speed Train System (referred to hereafter as the Statewide Program EIR/EIS) and again in the 2008 Bay Area to Central Valley HST Final Program EIR/EIS (referred to hereafter as the Bay Area to Central Valley Program EIR/EIS).

Stations will be located in the City of San Francisco at the Transbay Terminal and at 4th and King; in the City of Millbrae at the existing Millbrae BART/Caltrain station; and in the City of San Jose at the Intermodal Diridon station. One potential mid-peninsula station stop is also under consideration. Alternative locations being reviewed for this potential stop are in the City of Redwood City at the existing downtown Caltrain station; in the City of Palo Alto at the existing Caltrain station; and in the City of Mountain View at the existing Caltrain/VTA LRT station.

The Bay Area to Central Valley Program EIR was the subject of a lawsuit filed by the Town of Atherton and others in August 2008. In November 2009, the court issued its decision in the case. The court concluded that the EIR complied with CEQA in most respects, including its analysis of alternatives and its analysis of impacts and mitigation in the areas of biology, noise, aesthetics, growth and heritage trees. However, the court indicated that the EIR required corrective work and recirculation for certain issues regarding the segment between San Jose and Gilroy. In accordance with the court decision, the Authority has rescinded its resolution certifying the Bay Area Program EIR and is preparing revisions to the Program EIR identified by the court. On March 11, 2010, the Authority began circulating Revised Draft Program EIR Material for public review and comment prior to the Authority's consideration of the revised Program EIR.

Pre-scoping public outreach activities for the San Francisco to San Jose EIR/EIS were initiated in December 2008. Public scoping meetings were held in January 2009, and information meetings were held at the proposed/potential HST station locations. After the scoping period ended, an initial range of alternatives for the San Francisco to San Jose Section was developed. Because the Caltrain corridor is constrained by development on both sides, the alignment alternatives available are predominately vertical options. In Fall 2009, the initial alternatives were presented to the Technical Working Groups and Policymaker Working Group. In addition, three public workshops were held, and the regional team met with the staff of each City along the corridor to review the options. See Section 3.3.4 and Appendix F for further details regarding agency coordination and public outreach.

1.3 Study Area

The San Francisco to San Jose Section study area includes portions of San Francisco, San Mateo and Santa Clara counties and the Caltrain corridor which extends approximately 48 miles between the Transbay Terminal in San Francisco and San Jose Diridon Caltrain station. The railroad passes through 14 cities on the San Francisco Peninsula. While adjacent development is typically residential, commercial, office or industrial, many of the Caltrain stations are located in the commercial "downtown" of the communities they serve. The Caltrain corridor is primarily double track, with some segments consisting of 3, 4 or more tracks, and includes 23 Caltrain stations within the study area. Caltrain operates regional passenger rail service in the corridor and Union Pacific operates local freight service. Though many crossings have been grade-separated, there are 47 at-grade railroad crossing locations remaining within the study area. The existing Caltrain corridor and HST station locations are shown in Figure 1-1.

1.4 Purpose of Study

This Preliminary Alternatives Analysis (AA) Report documents preliminary planning, environmental, and engineering information used to identify feasible and practicable alternatives to carry forward for further engineering and environmental analysis. Additional outreach will occur as these preliminary recommendations are finalized which will inform preparation of the San Francisco to San Jose HST Project EIR/EIS. This report is intended to identify a range of potentially feasible alternatives for further analysis and consideration. It documents the preliminary evaluation of alternatives, indicating how each of the alternatives meets the purpose and need for the HST project, how evaluation measures were applied, the results of that analysis, and the identification of alternatives to carry forward for more detailed engineering and environmental analysis along with those alternatives not to be carried forward for further analysis.

This report primarily addresses potential horizontal and vertical configurations of HST alternatives along the Peninsula. The San Francisco to San Jose Section of the HST project also includes elements such as stations and a maintenance facility, which will be a focus of the design, environmental and outreach teams in the upcoming months. Maintenance facility alternatives will be addressed as part of a separate alternatives analysis process.

1.5 Organization of Report

This report is organized as follows:

- Section 1 – Introduction
- Section 2 – Alternatives development process
  - Procedures and methods used to develop and evaluate the alternatives
  - Purpose, goals and objectives
  - Goals of the Context Sensitive Solutions (CSS) process
- Section 3 – Alternatives
  - No Project alternative

  - Previously considered alternatives in the program-level EIR/EIS process
    - Routes
    - Stations
  - Alternatives considered and rejected
    - I-280
    - US 101
    - Caltrain corridor exclusive guideway
    - East Bay routes
    - Bay Area terminal stations
  - Development of alignment options for Caltrain shared use corridor
  - Initial review of vertical alignment options
  - Public and agency comments on initial options
  - Vertical options carried forward into detailed evaluation
- Section 4 – Development and evaluation of project alternatives
  - Definitions of vertical options
    - Aerial Viaduct
    - Berm
    - At Grade
    - Open Trench
    - Covered Trench/Tunnel
    - Deep Tunnel
  - Train operations and arrangement of tracks and station platforms
  - Methods for developing evaluation measures
    - Capital costs
    - Property impacts
    - Utilities
    - Environmental resources and other measures
  - Summary of evaluation results
    - Subsection 0 – Transbay Terminal to Mission Bay
    - Subsection 1 – Mission Bay to Brisbane
    - Subsection 2 – Brisbane to Millbrae
    - Subsection 3 – Millbrae to San Mateo
    - Subsection 4 – San Mateo to Redwood City
    - Subsection 5 – Redwood City to Menlo Park
    - Subsection 6 – Palo Alto
    - Subsection 7 – Mountain View to Sunnyvale
    - Subsection 8 – Sunnyvale to Santa Clara
    - Subsection 9 – Santa Clara to San Jose
- Section 5 – Analysis summary and conclusions
  - Alternatives to be carried forward for further engineering and environmental analysis
- Appendices
  - US 101/I-280 analysis
  - Alignment exhibits
  - Plans and profile drawings
  - Typical cross sections
  - Scoping and outreach comments
  - San Francisco terminal analysis
  - Existing right-of-way maps
  - Potential train schedules and operational analyses
  - Conceptual cost estimates

1.6 Context Sensitive Solutions

Context Sensitive Solutions (CSS), a collaborative community engagement process, will build upon on the extensive community outreach and public involvement conducted in the early outreach to agencies, stakeholders and the public with the review of initial project alternatives. Key objectives of CSS in the public review of the Preliminary Alternatives Analysis Report are to:

- Ensure that a broad range of stakeholders will be contacted and invited to participate in responding to the preliminary Alternatives Analysis documents, including communities, interest groups (business, labor, environmental), and public agencies (city, transportation, resource agencies), who are affected by or have an interest in the project

- Support community representative policymaker working groups and technical working groups to advise and provide constructive input on preliminary alternatives, evaluation methodologies and selection criteria through public meetings and workshops
- Support stakeholder education and constructive input on the preliminary alternatives, evaluation methodologies and selection criteria through public meetings and workshops
- Document the process and results of stakeholder engagement as public comment and input to the Preliminary Alternatives Analysis Report and other environmental reports that are part of the EIR/EIS as input to the Final Alternatives Report

Figure 1-1
San Francisco to San Jose HST Study Area

2.0 Alternatives Development Process

This study involves the identification, creation and refinement of alternatives, through a step-by-step series of processes to compare and evaluate alternatives. This study follows a defined alternative analysis process as described in the *Technical Memorandum Alternatives Analysis for Project-Level EIR/EIS* issued by the Authority (October 2009), included in Appendix G, and uses both qualitative and quantitative evaluation measures that reflect a mixture of applicable policy and technical considerations.

The analysis begins with the preferred alignment and station locations selected as part of the 2008 Final Bay Area to Central Valley HST Program EIR/EIS document. Public and agency comments in response to the Project EIR/EIS scoping processes and during ongoing interagency coordination meetings were used to identify initial alternatives to carry forward for detailed environmental review. After identifying initial project alternatives, alignment plans, profiles, and cross-sections have been developed and used for this preliminary evaluation of the alternatives.

The techniques that are used to gather information, develop and compare alternatives are described below:

Field Inspections of Corridor - The potential alignment, right-of-way, and station locations are the subject of field inspection by experienced planning personnel, engineers, and analysts with experience in railroad operations and design, to identify conditions and factors not visible in aerial photos or on maps. Over the course of the study, field inspections become progressively more detailed as the alternatives are refined by the planning and engineering work.

Project Team Input and Review - The project team conducts team meetings to discuss alternatives and local issues that potentially impact alignments.

Qualitative Assessment - A number of the qualitative measures used to describe the alternative alignments are developed by professionals with experience in the construction and operation of high-speed rail and other transportation systems. These measures include constructability, accessibility, operability, maintainability, right-of-way, public infrastructure impacts, railway infrastructure impacts, and environmental impacts.

Engineering Assessment - Engineering assessments are provided for a number of measures that can be readily quantified at this stage of project development. The engineering assessments can provide information on project length, travel time, and configuration of key features of the alignment such as the presence of existing infrastructure.

GIS Analysis - The bulk of the assessment is performed using GIS data, which enables depictions of the project's interactions with a variety of measurable geographic features, both natural and built. GIS data is used to assess impacts on farmland, water resources, floodplains, wetlands, threatened and endangered species, cultural resources, current urban development, and infrastructure.

2.1 HST Project Purpose

The purpose of the San Francisco to San Jose California High-Speed Train (HST) project is to implement the statewide HST System consistent with program-level decisions that will: (1) link Southern California cities, the Central Valley, Sacramento, and Bay Area; (2) provide a new transportation option that increases mobility throughout California; (3) provide reliable HST service that delivers predictable and consistent travel times using electric powered steel wheel trains, and (4) provide a transportation system that is commercially viable.

2.1.1 Objectives of the Statewide HST System and within the San Francisco to San Jose Region

The California High-Speed Rail Authority's statutory mandate is to plan, build, and operate a HST system that is coordinated with California's existing transportation network, particularly intercity rail and bus lines, commuter rail lines, urban rail transit lines, highways, and airports.

The Authority's objective is to provide reliable high-speed electric powered train service from San Francisco to San Jose that delivers predictable and consistent travel times. The San Francisco to San Jose Section of the HST System will provide greater access and choice of transportation modes, which will increase mobility throughout the region and contribute to the increased mobility throughout California.

This section of the HST System will connect the San Francisco Transbay Transit Center, which will serve as the northern terminus of the HST System in the San Francisco Bay Area, to the San Jose to Merced section in the south. Connectivity and accessibility will be enhanced through HST connections with Caltrain commuter rail service, AC Transit bus lines, SamTrans bus lines, Golden Gate Transit bus service, BART, Santa Clara Valley Transportation Authority light rail and bus lines, Altamont Commuter Express commuter rail service, Amtrak's Capitol Corridor, and San Francisco International Airport. Grade separation of the Caltrain corridor will enhance vehicle and pedestrian safety, improve air quality and reduce noise. Design practices will minimize and avoid environmental impacts to stream crossings that can serve as habitat for listed wildlife species such as the California red-legged frog. Potential impacts to neighborhoods and communities along the San Francisco to San Jose Section will be reduced by using the existing Caltrain transportation corridor and right-of-way to minimize right-of-way acquisitions, project design effects, and effects on community resources.

The Authority's objectives and policies for the proposed HST system are:

- Provide intercity travel capacity to supplement critically over-used interstate highways and commercial airports.
- Meet future intercity travel demand that will be unmet by present transportation systems and increase capacity for intercity mobility.
- Maximize intermodal transportation opportunities by locating stations to connect with local transit, airports, and highways.
- Improve the intercity travel experience for Californians by providing comfortable, safe, frequent, and reliable high-speed travel.
- Provide a sustainable reduction in travel time between major urban centers.
- Increase the efficiency of the intercity transportation system.
- Maximize the use of existing transportation corridors and rights-of-way, to the extent feasible.
- Develop a practical and economically viable transportation system that can be implemented in phases by 2020 and generate revenues in excess of operations and maintenance costs.

2.2 Identification of Alternatives to be Carried Forward

The aim of this alternatives analysis is to consider a wide range of options and to identify the alternatives to be carried forward for further engineering design and evaluation in the Draft EIR/EIS. Significant factors used to evaluate alternatives include:

- Ability to meet purpose and need and project objectives
- Engineering feasibility
- Likelihood of environmental approval
- Practicality and ability to construct the alternative
- Effect in reducing or avoiding adverse environmental impacts

2.3 HST Design Objectives

To determine each design option's ability to meet the HST Project's primary intent, the alternatives were evaluated using system performance criteria that address design differences and qualities in the alignment in terms of performance. These objectives and criteria are summarized in Table 2-1.

Table 2-1
Alignment and Station Performance Objectives and Criteria

Objective	Criteria
Maximize Ridership/ Revenue potential	Travel Time
	Route Length
	Ridership Forecasts
Maximize connectivity and accessibility	Intermodal connections
Minimize operating and capital costs	Operating and maintenance costs
	Capital cost

2.4 Comparison of Project Alternatives

In addition to the HST Project objectives and criteria presented above, five additional measures were used to evaluate and compare the project alternatives. Each of these measures is discussed in more detail below.

A. Land use supports transit use and is consistent with existing, adopted local, regional and state plans, and is supported by existing or future growth areas. Land use evaluation measures are summarized in Table 2-2.

Table 2-2
Land Use Evaluation Measures

Land Use		
Measurement	**Method**	**Source**
Development potential for Transit-Oriented Development (TOD) within walking distance of station	Identify existing and proposed land uses within 1/2-mile of station locations. Identify if there are TOD districts, TOD overlay zones, mixed use designations, or if local jurisdictions have identified station areas for redevelopment or economic development	Regional and local planning documents and land use analysis and input from local planning agencies.
Consistency with other planning efforts and adopted plans	Qualitative - general analysis of applicable planning and policy documents	Land Use Analysis. Baseline Conditions Study

B. Construction of the alternative is feasible in terms of constructability and right-of-way constraints. Constructability evaluation measures are summarized in Table 2-3.

Table 2-3
Constructability Evaluation Measures

Constructability and Right of Way		
Measurement	**Method**	**Source**
Constructability, access for construction, within existing transportation ROW	Extent of feasible access to alignment for construction	Conceptual design plans and maps
Disruption to existing railroads	Right-of-way constraints and impacts on existing railroads	Conceptual design plans and maps
Disruption to and relocation of utilities	Number of utilities diversions	Conceptual design plans and maps

C. Minimizes disruption to neighborhoods and communities – extent to which an alternative minimizes right-of-way acquisitions, minimizes dividing an established community, and minimizes conflicts with community resources. Community evaluation measures are summarized in Table 2-4.

Table 2-4
Community Evaluation Measures

Minimized Disruption to Neighborhoods and Communities		
Measurement	Method	Source
Displacements	If possible, number of properties by land use type that would be displaced. Or acres of land within the right-of-way/station footprint, by type of land use: single family, multifamily, retail/commercial, industrial, etc.	Identified comparing the alignment conceptual design drawings with aerial photographs, zoning maps, and General Plan maps.
Property with Access Affected	Identify potential locations along the alignments or at station locations where access would be affected.	Estimated off conceptual design plans and aerial photographs
Local Traffic Effects around Stations	Identify potential locations where increases in traffic congestion or LOS are expected to occur.	Existing traffic LOS from local jurisdictions
Local Traffic Effects at grade crossings	Identify potential locations at grade crossings where changes in traffic congestion or LOS are expected to occur.	Existing traffic LOS from local jurisdictions

D. Minimize impacts to environmental resources - extent to which an alternative minimizes impacts on natural resources. Environmental resources evaluation measures are summarized in Table 2-5.

Table 2-5
Environmental Resources Evaluation Measures

Minimized Impact on Environmental Resources		
Measurement	Method	Source
Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Identify new bridge crossings required; rough estimate of acres of wetlands, linear feet of waterways; acres and species of threatened and endangered habitat affected; acres of natural areas/critical habitat affected	Measured off conceptual design plans and GIS layers.
Cultural Resources	Identify locations of NRHP or CHRIS listed properties. For archaeological resources identify areas of high or moderate sensitivity based on previous studies conducted in the study area	Based on conceptual design plans and GIS layers; Section 4(f) studies and cultural resource records search and surveys.
Parklands	Number and acres of parks that could be directly and indirectly affected. This would also include major trails that would be crossed	Based on conceptual design plans and GIS layers; Section 4(f) studies
Agricultural Lands	Acres of prime farmland, farmland of statewide importance, unique farmland, and farmland of local importance within preliminary limits of disturbance	Based on conceptual design plans and GIS layers.

E. Enhances environmental quality — extent to which an alternative minimizes impacts on the natural environment. Natural environment evaluation measures are summarized in Table 2-6.

Table 2-6
Natural Environment Evaluation Measures

Minimize Impact on Natural Environment		
Measurement	Method	Source
Noise and Vibration effects on sensitive receivers	Identify types of land use activities that would be affected by HST passby noise and ground vibration.	Results of FRA screening level assessment. Inventory of potential receivers from site survey and aerial maps.
Change in visual/scenic resources	Identify number of local and scenic corridors crossed and scenic/visual resources that would be affected by HST elevated structures in scenic areas and shadows on sensitive resources (parks). Identify locations where residential development is in close proximity to elevated HST structures.	Result of general assessment. Survey of alignment corridors and planning documents.
Maximize avoidance of areas with geological and soils constraints	Identify number of crossings of known seismic faults, acres of encroachment into areas with highly erodible soils, acres of encroachment into areas with high landslide susceptibility.	USGS maps and available GIS data
Maximize avoidance of areas with potential hazardous materials	Hazardous materials/waste constraints	Data from previous records search conducted for other projects within study area.

2.5 Context Sensitive Solutions (CSS)

In response to public and agency comments on the need for a more collaborative process on how to integrate the high-speed train system and Caltrain 2025 projects into the physical environments of Peninsula cities, the Authority has adopted a Context Sensitive Solutions (CSS) approach for system design, including the San Francisco to San Jose Section. CSS is a process that involves interested parties in arriving at design solutions for public works projects, such as transportation improvements, that are sensitive to community concerns while also supportive of the objectives of the project.

CSS is creative, dynamic and interactive and focuses on solving problems that have been identified by a broad range of stakeholders, including communities, interest groups (business, labor, environmental), and public agencies (city, transportation, resource agencies), who are affected by or have an interest in the project. The stakeholders identify problems, issues and opportunities, and work with technical professionals to develop solutions that will meet common goals and objectives. According to the Joint AASHTO/FHWA Context Sensitive Solutions Strategic Planning Process Summary Report (March 2007), the core CSS principles that apply to transportation processes, outcomes, and decision-making are:

1. Strive towards a shared stakeholder vision to provide a basis for decisions.
2. Demonstrate a comprehensive understanding of contexts.
3. Foster on-going communication and collaboration to achieve consensus.

4. Exercise flexibility and creativity to shape effective transportation solutions, while preserving and enhancing community and natural environments.

CSS goals specific to the San Francisco to San Jose Section are:

- Ensure that community input is heard and considered during project planning and design;
- Assist cities and communities to define community-based measures of success and ensure that the project evaluation criteria reflect the goals of stakeholder interests, as well as project goals;
- Facilitate inclusive community engagement that focuses on creative solutions at the corridor and local community levels for alignment and station planning and design; and
- Support a corridor-wide advisory group that can represent community consensus on a preferred feasible and achievable project.

3.0 Alternatives

A two-step process was used for evaluation of project alternatives. At first, all available alignment alternatives were identified within each subsection and then each of these alignment alternatives was studied in detail using the evaluation measures presented in Section 2. In addition, a No Project Alternative was developed.

3.1 No Project Alternative

The No Project Alternative is the future condition absent the HST System. The No Project Alternative represents the state's transportation system (highway, transit, air, and conventional rail) as it is currently and as it would be after implementation of programs or projects that are currently identified in regional transportation plans (RTPs), have identified funds for implementation, and are expected to be in place by 2035, the study's planning horizon. This financially constrained level of infrastructure improvement (based on expected federal, state, regional, and local funding) was analyzed in consideration of the considerable growth in population and transportation demand that is projected to occur in the San Francisco Bay Area by 2035.

Proposition 1A specifies Phase 1 of the HST project as service between San Francisco, Los Angeles and Anaheim. Therefore, an option that terminates the HST system in San Jose with San Francisco passengers continuing north by transferring to Caltrain is not a viable alternative for the HST system. This option was previously considered and dismissed at the program level and would not meet the purpose and need and objectives of the HST system.

Under such an option, the lack of continued HST service to the peninsula, San Francisco Airport and downtown San Francisco would significantly reduce ridership throughout the HST system. Bay Area HST riders who access the system via transfer from transit (BART, MUNI, Golden Gate Transit, AC Transit and SamTrans) to Caltrain would be forced to make a second transfer at San Jose Diridon station from Caltrain to HST. Intermodal connectivity at SFO, the hub international airport for Northern California, would be significantly reduced. Many of the economic development opportunities in the northern Bay Area and peninsula communities that could occur with direct HST service to San Francisco would remain unrealized. As the terminal station, San Jose Diridon would experience increased vehicular traffic on the surrounding roadway and freeway network, and would likely attract much more intense economic development.

This section describes the existing and future conditions for highways, transit, air travel and conventional passenger rail within the San Francisco to San Jose corridor. With respect to high-speed train service, the No Project Alternative presents conditions as they would be if the statewide HST system is not built. The No Project Alternative satisfies the statutory requirements under CEQA and NEPA for an alternative that does not include any new action or project beyond what is already committed. The No Project Alternative is based on the following sources of information:

- State Transportation Improvement Program (STIP)
- The Regional Transportation Plan for the San Francisco Bay Area
- Airport Master Plans
- Intercity passenger rail plans

The future improvements that would be part of the No Project Alternative are also included under HST Build Alternatives as part of the future 2035 baseline. The No Project Alternative includes conventional passenger rail, highway, transit and aviation elements as discussed below.

3.1.1 Conventional Passenger Rail Element

Commuter rail services in the corridor are provided by Caltrain and ACE (Altamont Commuter Express) while intercity rail service is provided by the Capitol Corridor and Coast Starlight Amtrak service. ACE and Amtrak service is only provided in the southernmost segment of the corridor, between the Santa Clara and Diridon San Jose Caltrain stations.

Caltrain

Caltrain, operated by the Peninsula Corridor Joint Powers Board (JPB), operates 90 daily one-way trains between San Jose and San Francisco. Limited stop, express (Baby Bullet) trains have operated during peak hours since 2004, when new four-track segments were built and new rolling stock was acquired.

Though the JPB has a program called Caltrain 2025 to improve and expand commuter rail operations, it is not included in the No Project Alternative. Key elements of this program include electrification of the line from San Jose to San Francisco, acquisition of new electric locomotives or electric multiple units (EMUs), additional grade separations, station upgrades and improved signalization. This program calls for 114 daily one-way trains by 2035, speeds of up to 90 miles per hour and is compatible with planned high-speed rail service. JPB and Caltrain officials have publicly indicated that the electrification project and other program elements are not currently funded and unlikely to occur without the HST project. In addition, the Final EIR and decision on the electrification project has not yet acted upon by the JPB. Caltrain plans also include extending Caltrain to the Transbay Transit Center. This project is also not fully funded and is not included in the No Project Alternative.

Other Commuter and Intercity Rail Services

ACE, operated by the San Joaquin Regional Rail Commission (SJRRC), provides service between Stockton and San Jose with 3 westbound a.m. and 3 eastbound p.m. trips (6 daily trains). Programmed improvements include track and signal upgrades and a new maintenance facility in San Joaquin County. Additional service and capital improvements are being investigated as part of the Altamont Corridor Rail Project, which is now analyzing potential alternatives for inclusion in an EIS/EIR.

Capitol Corridor service is operated by Amtrak under the management of the Capitol Corridor Joint Powers Authority (CCJPA). Current service provides 7 daily round trips between Sacramento and San Jose and 16 daily round trips between Oakland and Sacramento. The programmed expansion plans (from the 2008 California State Rail Plan) call for an increase in San Jose – Sacramento service to 16 daily round trips by 2018. Additional track improvements are planned in the corridor, but the service would utilize the planned Caltrain improvements track and station improvements in the Santa Clara to San Jose segment of the line.

3.1.2 Highway Element

The highway routes that are included in the No Project Alternative are identified in Table 3-1. The No Project Alternative includes this existing highway system as well as funded and programmed improvements based on the financially constrained Regional Transportation Plan (RTP) developed by Metropolitan Transportation Commission (MTC). Highway improvements included in the No Project Alternative include infrastructure projects and other potential system improvements programmed to be built and in operation by 2035.

Table 3-1
Existing Highway Routes – San Francisco to San Jose

Interstate Highways	U.S. Highways	State Routes
Interstate 280 (I-280)	U.S. Highway 101 (US-101)	State Route 82 (SR-82)
Interstate 380 (I-380)	N/A	State Route 84 (SR-84)
Interstate 880 (I-880)	N/A	State Route 85 (SR-85)
N/A	N/A	State Route 92 (SR-92)
N/A	N/A	State Route 237 (SR-237)

The programmed highway improvements consist primarily of interchange and operational improvements, with limited roadway expansion. As such, the improvements do not cumulatively add substantial capacity to the highway system. The highway improvements included as part of the No Project Alternative are identified by county in Appendix I and are summarized below:

- New and upgraded interchanges along US-101
- Additional US-101 auxiliary lanes
- Operational improvements on US-101 and other corridor highway routes
- Conversion of some HOV lanes to HOT (High-Occupancy Toll) lanes
- New HOV / HOT lanes on segments of US-101 and I-880
- Local road widening and other improvements

3.1.3 Transit Element

In addition to commuter rail, other major transit services in the corridor are provided by San Francisco Muni, BART, AC Transit, SamTrans and VTA. Each provides local bus services that connect to existing and future rail stations. Muni and VTA also operate light rail systems that directly serve existing Caltrain stations in San Francisco, Mountain View and San Jose. BART serves the northern portion of the corridor with a line that connects downtown San Francisco with the San Francisco International Airport and the Millbrae Caltrain station.

The major programmed transit improvements consist of several new transit lines, facilities and extensions. The transit improvements included as part of the No Project Alternative are identified by county and regionwide in Appendix I and are summarized below:

- New Central Subway light rail line in San Francisco, connecting the 4th & King Caltrain station to Chinatown
- Replace Transbay Terminal, including construction of new Transbay Transit Center building (Phase 1)
- An extension of the 3rd Street Muni light rail line to the Bayshore Caltrain station, including development of an intermodal facility at the station
- Extension of BART from Warm Springs to downtown San Jose and Santa Clara, with a station at the San Jose Diridon Caltrain station
- VTA light rail extensions to Eastridge and Vasona Junction
- New VTA Bus Rapid Transit lines on Santa Clara/Alum Rock, El Camino Real (from San Jose to Palo Alto). Stevens Creek Boulevard (from San Jose to De Anza College) and Monterey Highway

3.1.4 Aviation Element

The air transportation system evaluated under the No Project Alternative consists of airports that currently provide commercial service in the San Francisco to San Jose Section. The airports do not necessarily provide commercial service between the same intercity markets as the proposed HST system. The commercial airports serving the San Francisco to San Jose Section are:

- San Francisco International Airport (SFO)
- Norman Y. Mineta San Jose International Airport (SJC)

A summary description of each airport is provided in Table 3-2 below.

Table 3-2
Existing (2009) Airport Facilities

Airport	Total Passenger Terminal Size	Total Boarding & Arriving Passengers (annual)[1]	Number of Runways	Number of Gates	Number of Parking Spaces	Size of Airport
San Francisco international Airport (SFO)	5,021,000 square feet	36 million	4	117	10,788	2,383 acres
Mineta San Jose International Airport (SJC)	403,800 square feet	9.7 million	3	28	8,500	1,000 acres

Sources:
Bay Area to Central Valley Program EIR/EIS, except as noted
1. Federal Aviation Administration 2008 Airline Passenger Boarding Statistics

San Francisco International Airport (SFO)

San Francisco International Airport (SFO) is located 13 miles south of downtown San Francisco in San Mateo County. The airport is operated by the City of San Francisco under the management of the San Francisco Airport Commission. SFO is the largest Bay Area airport and the tenth largest in the United States. In 2008 the airport served over 36 million annual passengers (boardings and arrivals) and future demand is projected to be more than 60 million passengers by 2035.

The airport has four operating runways. However, limited clearance between the runways restricts simultaneous arrivals during poor weather, resulting in frequent flight delays. According to the Regional Airport System Plan, SFO will not have sufficient capacity to meet future demand due to these operating constraints.

SFO is composed of four terminals that surround a central transportation hub. Terminal 2 (Central Terminal) is currently closed for a major renovation.

The transportation hub includes a multi-level parking garage, a BART station (at the International Terminal) and an automated guideway system (AirTrain) that serves each terminal, the BART station and the off-site rental car facility. BART has direct service from SFO to downtown San Francisco. There is also a BART track connection from SFO to the Millbrae Caltrain station, but direct revenue service from the airport to Millbrae is only provided on evenings and weekends. SFO is also served by SamTrans buses and a variety of private buses and shuttles.

Mineta San Jose International Airport (SJC)

Mineta San Jose International Airport (SJC) is located three miles north of downtown San Jose adjacent to highways 87 and 101. The airport is located in and operated by the City of San Jose. In 2008 the airport served 9.7 million annual passengers (boardings and arrivals) and is the 39th busiest commercial airport in the country. Future demand is estimated at over 16 million passengers by 2035.

Mineta San Jose is currently undergoing a major Airport Modernization Program. Through that program, a new runway has been constructed, so that two 11,000 foot commercial runways are now available, providing adequate capacity through 2035. There is also a shorter general aviation runway. Three terminals are in use at this time, but Terminal C will close when Terminal B is completed this year. At that time the airport will have 28 gates.

The improvement program also includes a new rental car and public parking facility adjacent to Terminal B. A future phase of the Modernization Program would further expand Terminal B, providing a total of 40 gates.

Programmed Airport Improvements

Statewide, the airport development process is distinct from the highway and rail development processes and is not documented in local/regional transportation plans or in the STIP. For this analysis and to conceptualize a No Project airport system, proposed airport improvements were evaluated based on a review of an approved or under-development airport master planning program, an environmental document, a regional aviation system planning document or a capital improvement program. Identified improvement plans that were reviewed are summarized below:

- San Francisco International Airport (SFO) – in addition to the current renovation of Terminal 2, the Airport Master Plan identifies the need for a solution to the current runway constraints in order to meet future capacity requirements. Several alternatives are currently under consideration with varying degrees of operational benefits and environmental impacts.
- Norman Y. Mineta San Jose International Airport (SJC) – the remaining phases of the Airport Master Plan include the completion of Terminal B and the South Concourse. This project will increase the number of potential gates from 28 to 40. The full terminal facility would be 1,700,000 square feet. The future expansion also includes additional public and rental car parking facilities. The RTP also includes a project to construct an automated people-mover system connecting the airport to VTA light rail, Caltrain and the future BART line.

3.2 Program Level Alternatives

The Statewide Program EIR/EIS for the CAHST was completed in November 2005. The Authority and FRA selected the technology for the HST vehicles and identified potential route and station location options through the program environmental analysis. For a more detailed examination of these issues, refer to the *California High-Speed Train Final Statewide Program EIR/EIS*.

The Statewide Program EIR/EIS examined three major alternatives for the statewide transportation network. They were:

No Project Alternative – The State's transportation network as it is today, along with funded projects included in regional transportation plans.

Modal Alternative – Enhancements to the State's transportation network using existing modes and technologies (mainly expanded airports and highways).

High-Speed Train Alternative – A new high-speed train system to connect California's major urban centers.

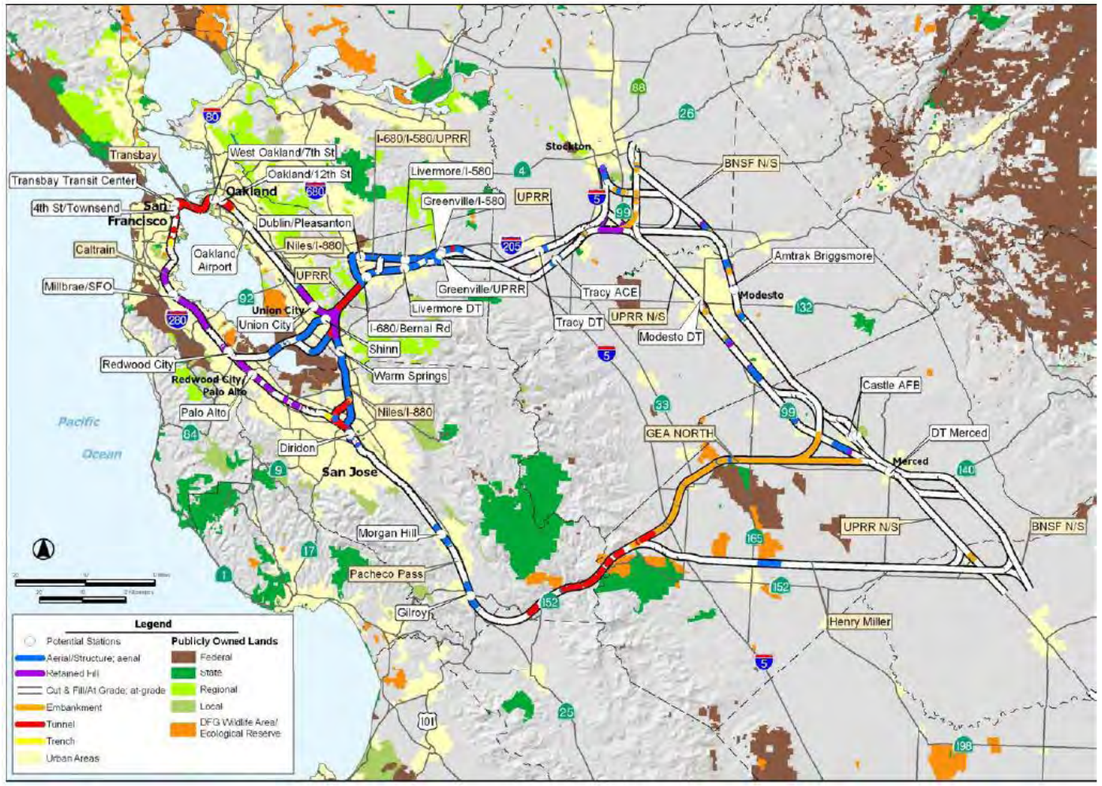
The HST Alternative was the selected system alternative in the Statewide Program EIR/EIS. The No Project Alternative was determined to be unable to provide the needed level of intercity mobility in the future, while the Modal Alternative provided reduced mobility compared to the HST Alternative. However, the Modal Alternative would have had a higher cost than the HST Alternative, and more significant environmental impacts.

3.2.1 San Francisco to San Jose Routing Alternatives

At the conclusion of the Statewide Program EIR/EIS, the Authority and FRA defined a broad corridor between the Bay Area and Central Valley for additional review in a second program–level EIR/EIS. The Bay Area to Central Valley Program EIR/EIS investigated a broad corridor generally bounded by and including Pacheco Pass (State Route 152) to the south, Altamont Pass (Interstate 580) to the north, the BNSF rail corridor to the east, and the Caltrain corridor to the west. Several operating scenarios for combinations of alignment alternatives and terminus stations were investigated, with HST network alternatives ranging from one to three termini (San Francisco, Oakland, and San Jose) for direct HST service to the Bay Area. As shown in Figure 3-1, the representative network alternatives were grouped into two basic approaches for linking the Bay Area and Central Valley: Altamont Pass and Pacheco Pass.

The Pacheco Pass alternative serving San Francisco and San Jose termini was selected for HST service between the Bay Area and the Central Valley. Chapter 8 of the Bay Area to Central Valley Program EIR/EIS describes the preferred HST network and alignment alternatives and station options as well as the evaluation of network alternatives that supported the identification of the preferred alternative. (As a result of a lawsuit, the Authority has rescinded its certification of the Bay Area Program EIR pending corrective work and recirculation for certain issues; see Section 1.2.)

Figure 3-1
Alignment Alternative and Station Location Options Considered in Bay Area to Central Valley Program EIR/EIS

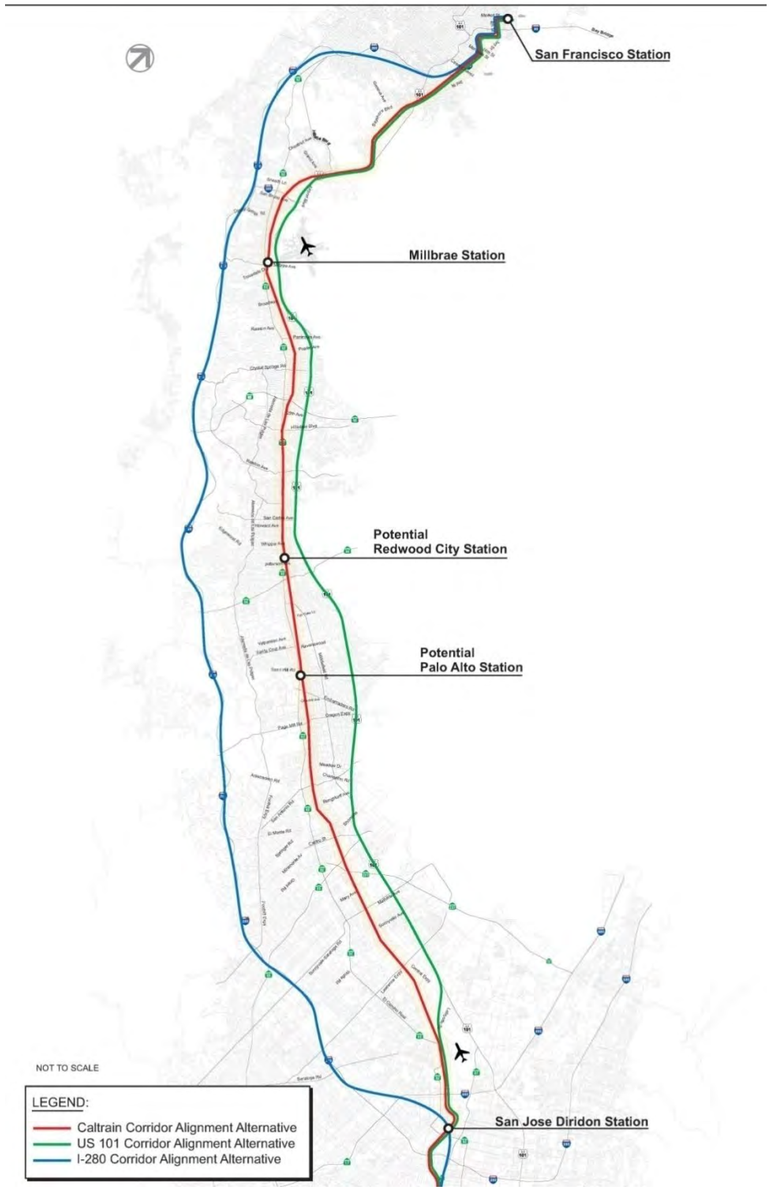


The Statewide Program EIR/EIS evaluated routing alternatives between San Francisco and San Jose. These options were further considered and reviewed in the Bay Area to Central Valley Program EIS/EIR. The program documents considered four HST corridor alignment alternatives between San Francisco and San Jose:

- I-280
- US 101
- Caltrain Corridor (Exclusive Guideway)
- Caltrain Corridor (Shared Use)

These corridor alignments are shown in Figure 3-2. As a result of the evaluation, the first three of these alternatives were removed from further study and the shared use Caltrain Corridor alternative was carried forward for further consideration.

Figure 3-2
Statewide Program EIR/EIS Corridor Alignment Alternatives – San Francisco to San Jose



3.2.2 Station Alternatives

The Statewide Program EIR/EIS considered station options at San Francisco, San Jose, Millbrae, Redwood City, Palo Alto and two airport connector station options: Millbrae and Santa Clara. These options were further considered and reviewed in the Bay Area to Central Valley Program EIR/EIS.

Downtown San Francisco Station Options

The HST program-level documents were predated by several environmental studies prepared by other agencies that considered route and station alternatives in Downtown San Francisco. These studies include:

- Caltrain San Francisco Downtown Extension Project Draft Environmental Impact Statement/Draft Environmental Impact Report and Draft 4(f) Evaluation, referred to hereafter as the Caltrain Downtown Extension DEIS/EIR (March 1997)
- Transbay Terminal Improvement Plan (2000)
- Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final Environmental Impact Statement/Environmental Impact Report referred to hereafter as the Transbay FEIS/EIR (April 2004)

In addition to these studies, a series of policy decisions by the San Francisco Board of Supervisors, the voters of San Francisco, and the Metropolitan Transportation Commission (MTC) in its role as the Bay Area Toll Authority (BATA) resulted in the rejection of a number of study alternatives. Among the alternatives considered and rejected during this process was retrofitting the Transbay Terminal to accommodate a Caltrain extension above ground, an underground terminal under Beale Street at Market Street, and moving the underground Beale Street terminal one block south to Mission Street. Reasons for rejecting the retrofitted Transbay Terminal alternatives included insufficient capacity to meet future demand, blighting effect of additional aerial ramps, and poor curve geometry for rail operations. The Beale Street alternatives were rejected because of poor pedestrian linkage to the Transbay Terminal, inefficiencies due to lack of tail tracks, and risk of excavating a tunnel directly adjacent to the Bay Bridge anchorage.

In April 2004, the TJPA and the Federal Transit Administration (FTA) selected the alternative that extends Caltrain below grade from the 4th& King station to a new terminal beneath a new Transbay Transit Center and certified the Transbay FEIS/EIR. The route from 4th & King would follow Townsend Street, turn north along Second Street to Howard Street, and turn east into the basement of the new terminal.

The HST program documents considered two station options in San Francisco:

- Transbay Transit Center
- 4th & King

The Transbay Transit Center was selected as the preferred location for the Downtown San Francisco terminus. The Transbay Transit Center would offer greater connectivity to San Francisco and the Bay Area than the 4th & King site because of its location in the heart of downtown San Francisco and because it would serve as the regional transit hub for San Francisco. The Transbay Transit Center is located in the financial district where many potential HST passengers could walk to the station. In contrast, the 4th & King station is more than 1 mi (1.6 km) from the financial district. As a result, it was estimated that the 4th & King station would attract about 1 million fewer riders annually than the Transbay Transit Center. The 4th & King station would not connect to BART or regional bus transit, while the Transbay Transit Center is expected to emerge as the transit hub for all major services to downtown San Francisco, with the advantage of direct connections to BART (1 block from the terminus), Muni, and regional bus transit (SamTrans, AC Transit, and Golden Gate District). Moreover, the Transbay Transit Center would be compatible with existing and planned development and is the focal point of the Transbay redevelopment plan that would include extensive high density residential, office, and commercial/retail development.

The rail facilities planned for the Transbay Transit Center include 6 tracks and 3 platforms, which would be shared by Caltrain and HST. The program documents noted that further cooperative operations planning analysis of Transbay Transit Center rail capacity was needed to determine the most efficient mix and scheduling of both HST and Caltrain commuter services.

Airport Connector Station Options

Two airport connector station options were considered for the San Francisco peninsula in the HST program documents; Millbrae for San Francisco International Airport (SFO) and Santa Clara for San Jose International Airport. SFO serves as the “hub” airport for international travel in Northern California and is located about 12 miles south of downtown San Francisco. The conceptual design is to link to SFO at the Millbrae Caltrain/BART station location which is adjacent to SFO (but not directly at the airport). This multi-modal station would link to the airport by the existing BART connection and could possibly be reached in the future by the airport people mover system.

A potential link to San Jose International Airport by a Santa Clara station would be less than 3 miles north of the proposed downtown San Jose station. Because the downtown San Jose (Diridon) station site would provide sufficient connectivity to San Jose airport for the foreseeable future, it was determined that the preferred HST alternative would not have an HST station at Santa Clara, and that the Millbrae (SFO) station is the preferred HST airport connector station on the San Francisco peninsula. The Millbrae (SFO) HST station supports the objectives of the HST project by providing an interface with the northern California hub airport for national and international flights.

Potential Mid-Peninsula Station

The HST program documents considered a potential optional station that would serve the Mid-Peninsula area. The two location options considered were in Redwood City and Palo Alto. The conclusion was that both of these potential location options should continue to be investigated as alternative sites for an optional Mid-Peninsula station, while working with local agencies and the Caltrain JPB to determine whether a Mid-Peninsula station should be recommended.

San Jose Diridon Station

The only San Jose station considered in the program EIS/EIR documents was the Diridon station that currently serves Caltrain and other transit modes and is adjacent to downtown San Jose. This station would provide significant multi-modal transit connections.

Summary of Proposed and Potential Station Locations

In summary, the following preferred station locations for HST service between San Francisco and San Jose were selected in the program documents:

Downtown San Francisco Terminus: Transbay Transit Center. This location would offer the greatest connectivity and accessibility to San Francisco and the Bay Area, best serve as a regional transit hub, and have the highest ridership potential.

San Francisco Airport Connector Station: Millbrae (SFO). This location supports the objectives of the HST project by providing an interface with the northern California hub airport for national and international flights.

Potential Mid-Peninsula Station: Work with local agencies and the Caltrain JPB to determine whether a mid-peninsula station should be developed and continue to investigate potential sites. (During the 2009 scoping process, the City of Mountain View requested that a potential station location option at the City of Mountain View Caltrain station also be considered. As a result, locations in Redwood City, Palo Alto and Mountain View are currently under consideration.)

Downtown San Jose Terminus: Diridon Station. This location maximizes connectivity to downtown San Jose, San Jose International Airport, and the southern Bay Area, and would have high ridership potential.

3.3 Initial Identification of Project Alternatives

The starting point for identifying project alternatives in the San Francisco to San Jose Section was the Caltrain corridor selected as the preferred alternative in the program-level analysis.

3.3.1 Alternatives Considered and Rejected

The three following route alternatives between San Francisco and San Jose that were considered and rejected in the program-level analysis were reviewed to confirm that no information undermines the initial rationale for their exclusion:

- I-280
- US 101
- Caltrain Corridor (Exclusive Guideway)

In program-level decisions, the fully grade-separated Caltrain shared use corridor was selected as the preferred alignment for HST service between San Francisco and San Jose. When the initial set of alternatives for the project-level Alternatives Analysis were being selected, it was found that sharing track with Caltrain is still the only realistic alternative for a direct HST link to San Francisco because of the lack of sufficient available right-of-way along the Peninsula and the high cost of acquiring additional right-of-way. Unlike the exclusive guideway options discussed below, which would require tall elevated structures along the Caltrain, US 101 or I-280 rights-of-way and extensive purchases of additional right-of-way, the Caltrain corridor shared-use option takes advantage of the existing rail infrastructure and maximizes the opportunity to provide rail service at grade where possible. In addition, the Caltrain shared use option provides safety and traffic benefits by grade-separating existing at-grade roadway crossings. Using the Caltrain alignment allows for significant travel time and capacity improvements of the existing Caltrain system by supporting the implementation of the Caltrain 2025 plan, including fully grade separating and electrifying the corridor.

The previously rejected alternatives were reviewed with respect to general project purpose and objectives, practicability constraints, and environmental criteria. General project purpose and objectives were considered in terms of ridership potential, connectivity and accessibility, incompatibility with existing or planned development, and severe operational constraints. Practicability constraints were considered in terms of cost, constructability, right-of-way constraints, and other technical issues. Environmental criteria were considered a reason for elimination when an option had considerably more probable environmental impacts than other practicable options for the same segment. The following paragraphs describe the alternatives considered and the reasons they were not carried forward. More detailed analysis, alignment drawings and photographs of the I-280 and US 101 alignments are presented in Appendix A.

I-280

In developed areas, the I-280 alternative would be a separate guideway on an elevated structure either in the median or to one side of the roadway. In the undeveloped areas, a separate at-grade guideway alongside the freeway may be possible.

The terrain along I-280 is hilly and considerable earthwork or retaining walls likely would be needed. The areas through Palo Alto and Woodside are nature preserves, so encroachment outside the freeway right-of-way would have potential adverse impacts. Due to mountainous terrain, there are many curves that would restrict speed for high-speed train service for those areas where the guideway would have to be within the freeway right-of-way. If HST were to be located in the median of I-280, the travel time requirement of 30 minutes between San Francisco and San Jose would not be met. Instead, the approximate travel time for the I-280 median configuration would be 40 minutes. If the alignment were to meet the 30 minute travel time requirement there would be a significant need for additional right-of-way, including encroachments into existing uses such as parkland, open space, residential, commercial and schools.

The vertical alignment may also be incompatible in some areas, both in terms of grades and vertical curvature and thus would require tall viaducts or deep tunneling. Appendix A presents the vertical and horizontal alignment challenges at representative segments along the I-280 alternative. An alignment along the I-280 freeway would also encounter difficulties at freeway interchanges with SR-17/I-880, SR-85, and SR-92 as described below for the US 101 corridor.

For the proposed and potential HST stations in the San Francisco to San Jose Section, connectivity to the existing rail and transit infrastructure would not be possible except at either end of the line in San Francisco or San Jose:

> San Jose Diridon: It would not be feasible to stop at Diridon Station with the I-280 alignment; instead the area above I-280 freeway between Bird Avenue and Lincoln Avenue would be a possible location for a station. This location would have minimal connectivity with the major transit providers in the area.
>
> Mid-Peninsula station: A mid-Peninsula station would most likely be near an interchange on the I-280 freeway. Transit connections from the existing downtown to the new station would be required. In most cases this type of station area development would be inconsistent with the surrounding area and possibly current land uses. Additionally, transit oriented development opportunities may be limited in these generally undeveloped areas.
>
> SFO connection: There are two possible options: a stop at the I-380 interchange or bringing the rail alignment down the I-380 corridor and stopping at a location near the airport. In both cases some sort of new shuttle would be required to transfer passengers to the terminals at SFO.
>
> Downtown San Francisco: Depending on the alignment, HST could either join the existing Caltrain corridor near the intersection of I-380 and US 101, or continue along the I-280 alignment to downtown San Francisco.

Placing HST in the I-280 corridor has the potential to disturb sensitive biological resources and encroach into hazardous areas, all of which can trigger additional mitigation and engineering costs. In particular, the I-280 alignment could encroach into lands that are considered to be "protected areas of open space." Protected areas encompass watershed lands, parks, and open space trust lands. In order to maintain the design speed and curves along I-280, portions of the I-280 alignment, particularly along Crystal Springs on the west side of I-280, may be affected. These are watershed lands, owned and maintained by the City and County of San Francisco. Other potentially affected protected areas includes parklands within the City of San Jose and watershed lands along the Guadalupe River. Both of these types of protected areas would involve further approvals – specifically, Section 4(f) evaluations would need to be prepared for the parks and possibly a Section 408 consultation with the US Army Corps of Engineers would be required for effects to the flood control improvements along the Guadalupe River.

The I-280 alignment through San Mateo and Santa Clara counties is recognized for its high visual quality, and particularly for the design of the freeway to be complementary and harmonious with the natural terrain and topography. In acknowledgment of the visual character of the corridor and the freeway design, the State has declared I-280 through these counties as a state scenic highway. The introduction of a new guideway to support the HST in this visual landscape would raise concerns regarding its visual impact and would warrant special evaluation and design to ensure that this alignment respects the state's designation.

These constraints and lack of connectivity to other transit infrastructure detailed above highlight the major areas that constrain the I-280 corridor when it is considered as an HST alignment alternative. No information identified undermines the initial rationale for the exclusion of the I-280 alignment. The alignment would be impractical and potentially infeasible when other alignment options are available.

US 101

Similar to the I-280 alignment, the US 101 alternative would be an exclusive guideway in the US 101 freeway corridor between San Francisco to San Jose. Unlike the I-280 alignment where horizontal and vertical constraints are predominant, the US 101 alignment is predominantly constrained by existing bridges that would have to be crossed by the HST alignment. This exclusive guideway alignment would have major construction issues such as the construction of an aerial guideway adjacent to and/or above an active existing freeway facility which could require temporary relocation of some existing roadway facilities. The US 101 alignment would require many sections of high-level structures to pass over existing overpasses and connector ramps, resulting in high construction costs and constructability issues that would make this option impractical. The SR85 and SR 92 interchanges would require either tall HST viaducts or redesign and reconstruction of these interchanges. Both of these interchanges are constrained within a tight right-of-way corridor and modifications to these facilities would also have a corresponding right-of-way impact.

The aerial portions would introduce a major new visual element along the US 101 corridor that would have impacts on the residential portions of this alignment. In areas near airports, such as Moffett Field and SFO, the aerial alignment would have to transition to a trench or tunnel to avoid impacts to the flight path approaches. In addition, the freeway has substandard features (e.g., medians and shoulders) in many places, and it is assumed that any space that might be available for HST facilities would likely be used by Caltrans to upgrade the freeway to current standards in these areas. For example, the auxiliary lane project currently under construction along US 101 through the cities of San Mateo and Burlingame utilizes the highway right-of-way to its maximum extent and would restrict availability of right-of-way for the HST facilities.

An alignment generally following the US 101 corridor that would meet the travel time requirement of 30 minutes would require extensive additional right-of-way through adjacent residential areas to provide curves of sufficient radius to meet the 125 mph design speed. An HST alignment that more closely followed the US 101 freeway to avoid these right-of-way impacts would have a travel time of 35 minutes which would not meet the required travel time of 30 minutes. The longer travel time is a result of tighter curves that could only be traveled at lower speeds.

For the proposed and potential HST stations along the San Francisco to San Jose Section, connectivity to the existing rail and transit infrastructure would not be possible,except at either end of the line in San Francisco or San Jose:

> San Jose Diridon: The HST San Jose station could remain as planned at the existing San Jose Diridon station

Mid Peninsula station: A mid Peninsula station would most likely be near an interchange on the highway. Transit connections from the downtowns would be required. In most cases this type of land use would at least be new to the surrounding area and possibly inconsistent with the current land uses.

SFO connection: A station could be built along the US 101 alignment near the airport. The HST alignment would need to be either at-grade or tunneled to avoid violation of airspace restrictions around SFO. The station would not have a direct connection to BART or Caltrain as would be possible if HST were on the Caltrain corridor.

Downtown San Francisco: HST could join Caltrain near the San Francisco County/San Mateo County Line and continue on the Caltrain corridor to downtown.

Placing HST in the US 101 corridor has the potential to disturb sensitive biological resources and encroach into hazardous areas, all of which can trigger additional mitigation and engineering costs. Based on National Wetland Inventory data, the US 101 alignment would result in the greatest amount of potential wetland disturbance. In order to achieve the desired design speeds and design criteria for curves, the US 101 alignment would run to the east of US 101 in two areas that contain sensitive wetland habitat, Sanchez Lagoon in Burlingame and Seal Slough in Redwood City. It is in these two locales that the vast majority of the potentially affected wetlands occur. Potential fill of wetlands is regulated by the US Army Corps of Engineers and the US Environmental Protection Agency, and were this alignment to be advanced, the federal agencies would require evidence that there is no practicable alternative that could avoid these impacts.

The US 101 alignment, for more of its length than either the Caltrain or the I-280 alignments, runs closer to the Bayfront. As such, the US 101 alignment encroaches into a greater amount of land that was once along the historic edge of San Francisco Bay, prior to the extensive fill and reclamation projects that moved the edge of the Bay eastward. The proximity of the US 101 alignment to the bayfront means that it encroaches into more areas that are characterized by Bay Muds and, thus, susceptible to liquefaction – commonly described as transforming the earth to a quicksand-like consistency during an earthquake. The engineering costs to ensure the structural integrity of columns and foundations placed on liquefiable soils is greater than on soils with a low potential for such hazards.

The US 101 alignment, by virtue of running near the Bayfront, is also much more susceptible to flood hazards than the other alignments. Actual flood risks associated with this encroachment will vary based on the vertical profiles (e.g., an elevated alignment would have much less effect and expose fewer to flood hazards than an at-grade alignment); nevertheless, each of the alignments that pass through flood hazard areas has the potential to reduce floodplain capacity and increase the areal extent of the area subject to flooding. These potentially adverse effects are substantially greater with the US 101 alignment.

These constraints and lack of connectivity to other transit infrastructure detailed above highlight the major areas that constrain the US 101 corridor when it is considered as an HST alignment alternative. No information identified undermines the initial rationale for the exclusion of the US 101 alignment. The alignment would be impractical and potentially infeasible when other alignment options are available.

Caltrain Corridor (Exclusive Guideway)

This alternative would be an exclusive HST guideway along the Caltrain rail alignment between San Francisco and San Jose. This type of exclusive guideway alignment would be impractical because it would have major construction issues and high capital costs involving the construction of an aerial guideway adjacent to and above an active existing transportation facility, while maintaining rail traffic. This alternative would require the extensive purchase of additional right-of-way and construction of a number of elevated aerial structures between San Francisco and San Jose.

The exclusive HST guideway would preclude some future options by Caltrain to grade separate the existing at-grade crossings. As a result, the Peninsula Corridor Joint Powers Board (PCJPB), which owns the Caltrain right-of-way, has rejected this alternative. Instead, the PCJPB and the Authority have entered into several Memorandums of Understanding (MOU) to cooperate relative to the proposed development of an HST system for California that would share the PCJPB-owned rail corridor between San Francisco and San Jose, with the goal of implementing a fully compatible joint project of commuter rail rapid transit and intercity high speed rail projects.

The introduction of the separate elevated structure for the high-speed tracks and stations would also have adverse impacts along the Caltrain corridor. Compared to the Caltrain shared use alternative described in Section 3.3.2, the exclusive guideway would represent more of a physical barrier for land use and urban design, have more impacts on cultural resources and be less compatible with existing and planned development on the Peninsula. For these reasons, Caltrain Corridor (Exclusive Guideway) alternative was not carried forward in the alternative development process.

3.3.2 Development of Options for the Caltrain Shared Use Corridor

Corridor Characteristics

The existing Caltrain corridor is generally a two-track railroad serving diesel hauled commuter trains. A limited number of diesel freight trains also operate in the corridor. The railroad was originally built in the 1860s and has been incrementally upgraded since that time. Over the years, tracks were added to create a two-track system, with some four-track sections to allow operation of Baby Bullet express trains.

Road crossings have also been grade-separated over time. Some of the oldest grade separations in Palo Alto and San Jose were constructed in the 1930s, while others in Santa Clara, Sunnyvale and Mountain View were built in the 1960s and 1970s. Some grade separation projects are less than 15 years old, such as those in San Carlos, Belmont and Redwood City. Finally, some grade separations have been upgraded in the last 20 years, such as those at Millbrae Avenue in Millbrae and East Grand Avenue in South San Francisco. However, over 40 at-grade roadway crossings still exist, which would need to be grade-separated under the HST project.

As a result of incremental improvements over its 140-year history, the character of the existing Caltrain corridor varies substantially over the course of its length. Some portions are modern, grade-separated four-track examples of a high capacity railway, such as sections in Santa Clara, Sunnyvale, Redwood City and Brisbane. Other portions are closer to the railroad's earlier beginnings, with narrow rights-of-way passing close-by homes and business, such as sections in Menlo Park, Atherton and San Mateo. In some cities, the character changes quickly, such as in Palo Alto where at-grade roadway crossings alternate with grade-separations.

Comments received from the public during the scoping process reflected the varying character of the Caltrain corridor. Appendix E summarizes the scoping comments and notes their disposition regarding whether they will be addressed in the Alternatives Analysis. Many comments focused on the future vertical configuration of the railroad, often at specific locations. As seen in Appendix E, suggestions ranged from placing the tracks underground to placing them on an aerial structure. Taken broadly, the scoping comments requested that all possible vertical configurations be considered for every portion of the corridor.

Vertical Options

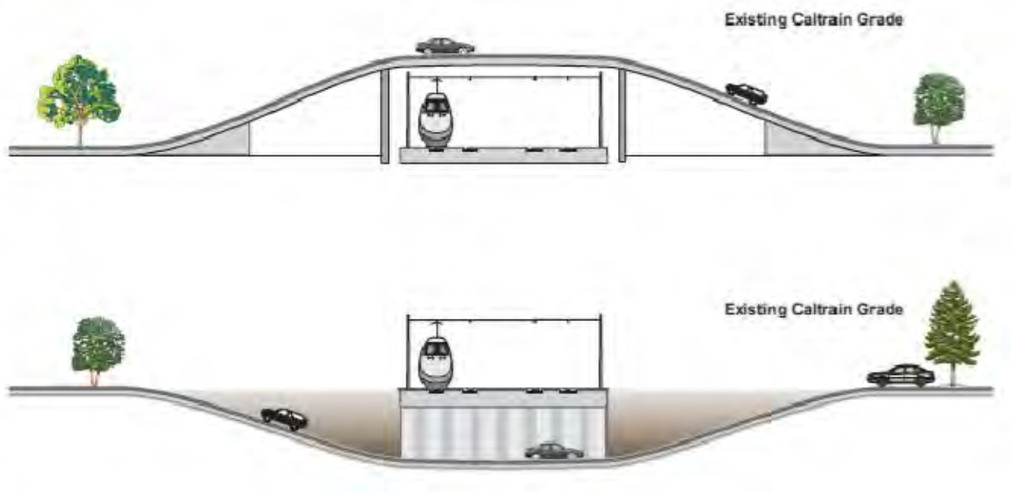
The project alternatives focus on the vertical placement of tracks within the Caltrain shared-use corridor. Three vertical options were defined for the initial development of alternatives:

- Elevated – on a berm or aerial structure above the existing Caltrain tracks. Figure 3-3 below shows the typical configuration for a roadway crossing under elevated tracks.

Figure 3-3
Typical Section for Elevated Option

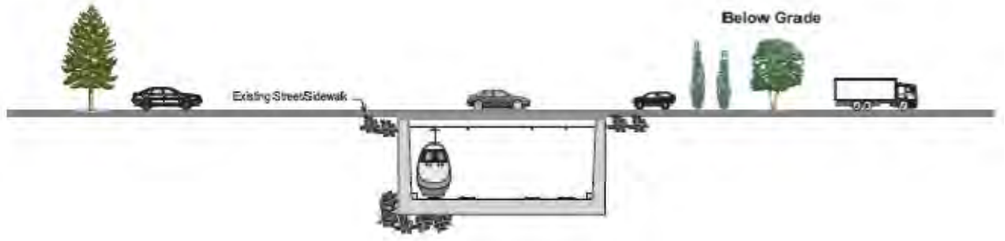
- Existing Caltrain Grade – usually at surface level, but sometimes an aerial, berm, trench or tunnel configuration if the existing Caltrain tracks are in that configuration. Figure 3-4 below shows the typical configuration for a roadway going under or over the tracks.

Figure 3-4
Typical Sections for Existing Caltrain Grade Option



- Below Grade – in a trench, a partially covered trench, or a tunnel (defined as an enclosed space) below the existing Caltrain tracks. Figure 3-5 shows the typical configuration of a roadway crossing over below grade tracks.

Figure 3-5
Typical Section for Trench/Tunnel Railroad Crossing



Defining Subsections

As discussed above, conditions affecting the vertical placement of tracks vary substantially along the section, and the preferred vertical option could very well change from one location to another. Therefore, the section was divided into 10 subsections (subsection 0 through 9) selected to group areas with common characteristics, such as:

- Municipal and County jurisdictions
- Existing roadway crossing conditions
- Land use adjacent to tracks
- Existing track configuration

The subsections were further divided into sub-subsections to group together common grade-separation conditions. Sub-subsections limits were typically located where it may be desirable to transition from one vertical option to another.

Downtown San Francisco Options

The 2008 Final Program Level EIR/EIS stated that to serve all of the HST trains proposed in the Authority's program-level operational plan, four tracks and two island platforms would have to be dedicated to HST service at the Transbay Transit Center. Following the publication of the Final Program EIR/EIS document, the 2008 Business Plan revised the forecasted ridership and revenue for the HST system statewide. An increase in forecasted ridership led to a reexamination of the number of trains required to accommodate this new total demand in ridership for the entire system and for downtown San Francisco. Based on the new ridership forecast, cooperative operations planning analyses of the TTC rail capacity was conducted by TJPA, the Authority and Caltrain. These conceptual operational studies focused on designing a feasible station configuration that could process 10 Caltrain trains and 10 HST trains per hour per direction into Downtown San Francisco.

The development of alternatives in Downtown San Francisco was also informed by recent studies performed as part of the preliminary design effort for the TTC/Caltrain Extension project. In 2006, underground train storage at the 4th & King location was considered and rejected due to limited and difficult access. In the first half of 2009, a double deck train box under the TTC was considered and rejected due to constructability concerns.

Cooperative operations planning analysis of Transbay Transit Center rail capacity is ongoing to determine the most efficient mix and scheduling of both HST and Caltrain commuter services. Three alternatives were identified to represent the possible range of operating concepts:

a. The Transbay Transit Center and the 4th & King station would serve both HST and Caltrain.

b. The Transbay Transit Center would serve both HST and Caltrain and the 4th & King station would serve Caltrain only. (This alternative represents the preferred alternative from the program-level analysis)

c. The Transbay Transit Center would serve Caltrain and the 4th & King station would serve both HST and Caltrain.

As a result of comments received during scoping, a fourth alternative was identified and designated "d." In this alternative, the train station at the Transbay Terminal would be located in the two-block area bordered by Beale Street, Harrison Street, Main Street and Folsom Street. The tracks between the new station and 4th & King would follow Beale Street, the Embarcadero and Townsend Street. The Beale Street station and the 4th & King station would serve both HST and Caltrain. Though the TJPA had studied and rejected Beale Street alternatives in their earlier work, these alternatives were different than Option "d." Evaluation of alternative configurations for the San Francisco HST terminus station is necessary given the Authority's obligations under CEQA and FRA obligations under NEPA when considering the implementation of the HST system.

3.3.3 Initial Review of Vertical Alignment Options

The subsections were examined to identify potentially practicable alternatives. Vertical options were dropped from further consideration due to environmental or engineering issues that would make approvals or implementation impractical. Vertical options were also dropped if they would not reduce or avoid adverse environmental impacts, would not meet purpose and need and project objectives, or would not be practical to construct. At its most basic level, this initial review focused on whether or not existing major structures, creeks, or waterways were in the way of the vertical option, which would have to be removed and/or replaced if the vertical rail option was to be built.

The following discussion describes the key features and issues for each subsection and identifies any potential conflicts or constraints that would prevent options from being further considered. The options removed from further evaluation are identified along with the key factors for those recommendations.

Note that the following paragraphs describe the initial review of options. This initial review presented to local agencies and the public as a part of the outreach efforts described in Section 3.3.4. Based on comments and information received during these outreach activities, some of options that were initially identified for potential removal were retained for further evaluation. Section 3.3.3 presents the options that were carried forward for detailed evaluation. The results of this detailed evaluation are presented in Section 4.

Subsection 0 - Transbay Terminal to North of Common Street

This subsection is located within the City and County of San Francisco. The existing Caltrain alignment extends from the platforms at the 4th & King station to the end of the subsection north of Mission Bay Drive. Though there are no existing tracks between the Transbay Transit Center and the 4th & King Caltrain station, Alternatives 0(a)A and 0(b)A assume that tracks will be added in an alignment under Seventh, Townsend and Second Streets. Alternative 0(d)A assumes tracks would be added under Seventh, Townsend and Beale Streets to serve an underground terminal between Beale and Main Streets oriented 90 degrees from the terminal assumed in Alternatives 0(a)A and 0(b)A.

The summary of the evaluation of these four alternatives is presented in Table 3-3 and Figure 3-6. The I-80 Bay Bridge approach structure and I-280/Fifth and Sixth Street ramps are constraints for the elevated option. The area between Transbay Terminal and 4th & King Station is a densely developed portion of Downtown San Francisco with closely spaced streets and multistory buildings. The at-grade option was dropped in this area because it would result in substantial property acquisitions and disruption.

Table 3-3
Initial Review of Vertical Options– Subsection 0

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
Subsection 0(a)A HST and Caltrain to both Transbay and 4th & King					
0(a)A	n.a.	Elevated		✓	Conflicts with I-80 structure and I-280 ramps
		At Grade		✓	Would cause significant community disruption and property acquisition north of 4th & King
		Below Grade	✓		
Subsection 0(b)A HST to Transbay, Caltrain to both Transbay and 4th & King					
0(b)A	n.a.	Elevated		✓	Conflicts with I-80 structure and I-280 ramps
		At Grade		✓	Would cause significant community disruption and property acquisition
		Below Grade	✓		
Subsection 0(c)A HST to 4th & King, Caltrain to both Transbay and 4th & King					
0(c)A	n.a.	Elevated		✓	Conflicts with I-280 ramps (HST to 4th & King only)
		At Grade	✓		
		Below Grade	✓		
Subsection 0(d)A HST to Beale Street, Caltrain to both Beale Street and 4th & King					
0(d)A	n.a.	Elevated		✓	Conflicts with I-80 structure and I-280 ramps
		At Grade		✓	Would cause significant community disruption and property acquisition
		Below Grade	✓		

Figure 3-6
Subsection 0 – Vertical Alignment Options

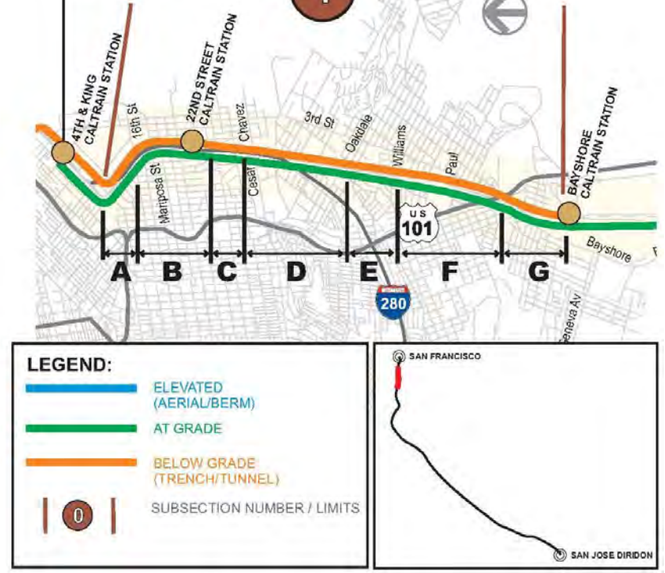
Subsection 1 – North of Mission Bay Drive to South Portal Tunnel No. 4

This subsection is located within the City and County of San Francisco. Except for two crossings near Mission Bay, all other street crossings in this subsection are grade-separated. The existing Caltrain alignment passes through a series of hills and valleys necessitating 4 tunnels and several embankment and trench segments. The I-280 freeway structure above the tracks and its support columns are constraints in the northern portion of the subsection for the elevated option. The existing Caltrain grade (including widening of existing tunnels) and new below grade options were carried forward throughout the subsection. The summary of the evaluation is presented in Table 3-4 and Figure 3-7.

Table 3-4
Initial Review of Vertical Options – Subsection 1

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
1A	1.03	North of Mission Bay Drive			
		Elevated		✓	Conflicts with existing I-280 aerial structure
		At Grade	✓		
		Below Grade	✓		
1B	1.32	South of 16th Street			
		Elevated		✓	Conflicts with existing I-280 aerial structure
		At Grade		✓	Conflicts w/ columns from I-280 aerial structure
		Below Grade	✓		
1C	2.07	South of 23rd Street			
		Elevated		✓	Precluded by hilly terrain; exceeds maximum allowable grade
		At Grade		✓	Inadequate transition distance to Below Grade option in subsection 1B
		Below Grade	✓		
1D	2.29	North of Cesar Chavez Street			
		Elevated		✓	Streets already grade-separated
		At Grade	✓		
		Below Grade	✓		
1E	3.21	South of Quint Street			
		Elevated		✓	Precluded by hilly terrain; exceeds maximum allowable grade
		At Grade	✓		
		Below Grade	✓		
1F	3.87	North of Williams Street			
		Elevated		✓	Streets already grade-separated; limited transition distance
		At Grade	✓		
		Below Grade	✓		
1G	4.36	South of Paul Avenue			
		Elevated		✓	Precluded by hilly terrain; exceeds maximum allowable grade
		At Grade	✓		
		Below Grade	✓		

Figure 3-7
Subsection 1 –Vertical Alignment Options



Subsection 2 – South Portal Tunnel No. 4 to South of Millbrae Avenue

This subsection is located in the cities of Brisbane, South San Francisco, San Bruno and Millbrae. The existing Caltrain alignment is at-grade in this subsection and many crossings are grade-separated. The northern portion of this subsection is completely grade-separated and includes an existing 4-track segment in Brisbane. In the southern portion of the subsection, BART runs alongside the Caltrain tracks. Existing aerial roadway structures crossing above the tracks in portions of the subsection constrain the elevated option, except over Linden Avenue and Center Street. The BART box and street undercrossings in the southern portion of this subsection constrain the below-grade option, except in the vicinity of the Millbrae station. The existing Caltrain grade option was carried forward throughout the subsection. The summary of the evaluation is presented in Table 3-5 and Figure 3-8.

Table 3-5
Initial Review of Vertical Options – Subsection 2

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
2A	5.77	South Portal Tunnel No. 4			
		Elevated		✓	Precluded by existing aerial structures, including US 101, Sierra Point, Oyster Point; not compatible with freight operation at South San Francisco yard; portion in Brisbane is already 4-track
		At Grade	✓		
		Below Grade		✓	Streets already grade-separated; not compatible with freight operation at South San Francisco yard; portion in Brisbane is already 4-track
2B	9.93	South of Colma Creek			
		Elevated	✓		
		At Grade	✓		
		Below Grade		✓	Transition distance too short to accommodate both Airport Blvd. and BART underground structures
2C	10.96	South of I-380			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		
2D	13.20	South of Center Street			
		Elevated		✓	Conflicts with Millbrae Ave. structure and BART station
		At Grade	✓		
		Below Grade	✓		

Figure 3-8
Subsection 2 – Vertical Alignment Options

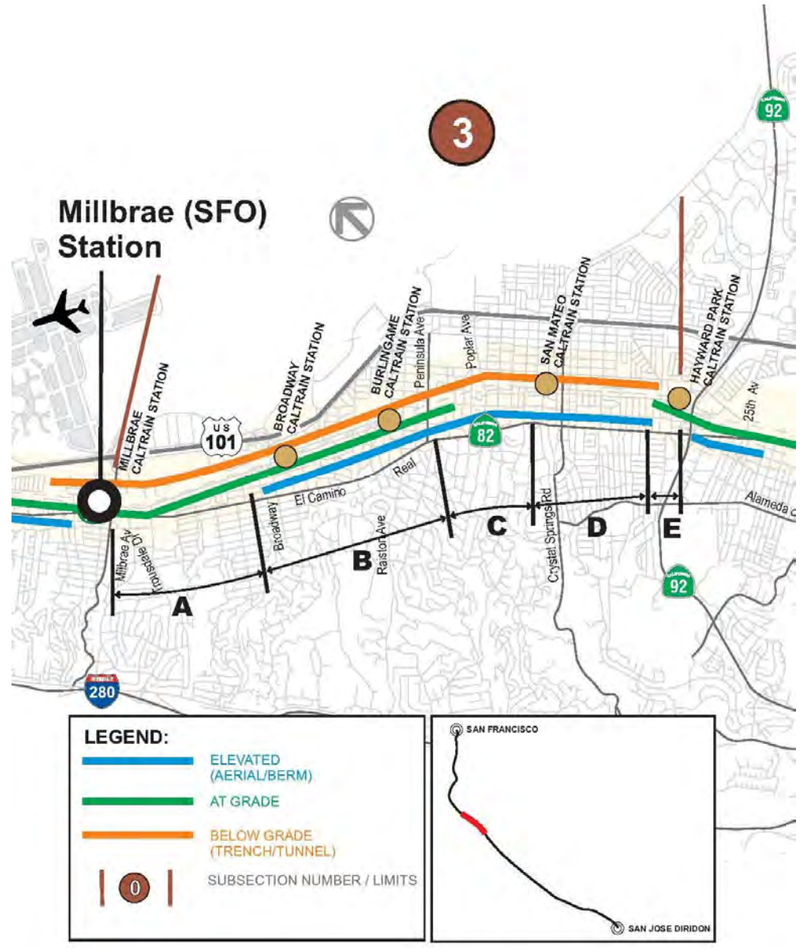
Subsection 3 – South of Millbrae Avenue to North of Highway 92

This subsection is located in the cities of Burlingame and San Mateo. In this subsection, the Caltrain tracks are primarily at-grade as are most of the crossings; those that are grade-separated have sub-standard clearances. This subsection includes a narrow ROW area through downtown San Mateo where a number of closely spaced at-grade crossings are an integral part of the street grid. In this area (subsections 3C and 3D), the existing Caltrain grade option was dropped because bringing the closely spaced at-grade crossings over or under the tracks would result in substantial property acquisitions and disruption to the downtown area. The elevated and below grade options were carried forward through most of the subsection. At the south end, only the existing Caltrain grade option was carried forward. The summary of the evaluation is presented in Table 3-6 and Figure 3-9.

Table 3-6
Initial Review of Vertical Options – Subsection 3

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
3A	14.38	South of Millbrae Avenue			
		Elevated		✓	Streets already grade-separated
		At Grade	✓		
		Below Grade	✓		
3B	15.14	South of Mills Creek			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		
3C	17.04	North of Villa Terrace			
		Elevated	✓		
		At Grade		✓	Building Villa Terrace and Belleview crossings under or over RR would cause community disruption and property acquisition
		Below Grade	✓		
3D	17.84	North of San Mateo Station			
		Elevated	✓		
		At Grade		✓	Building closely spaced downtown San Mateo road crossings under or over RR would cause significant community disruption and property acquisition
		Below Grade	✓		
3E	18.83	North of Hayward Park Station			
		Elevated		✓	Streets already grade-separated
		At Grade	✓		
		Below Grade		✓	Streets already grade-separated

Figure 3-9
Subsection 3 – Vertical Alignment Options



Subsection 4 – North of Highway 92 to North of 5th Avenue

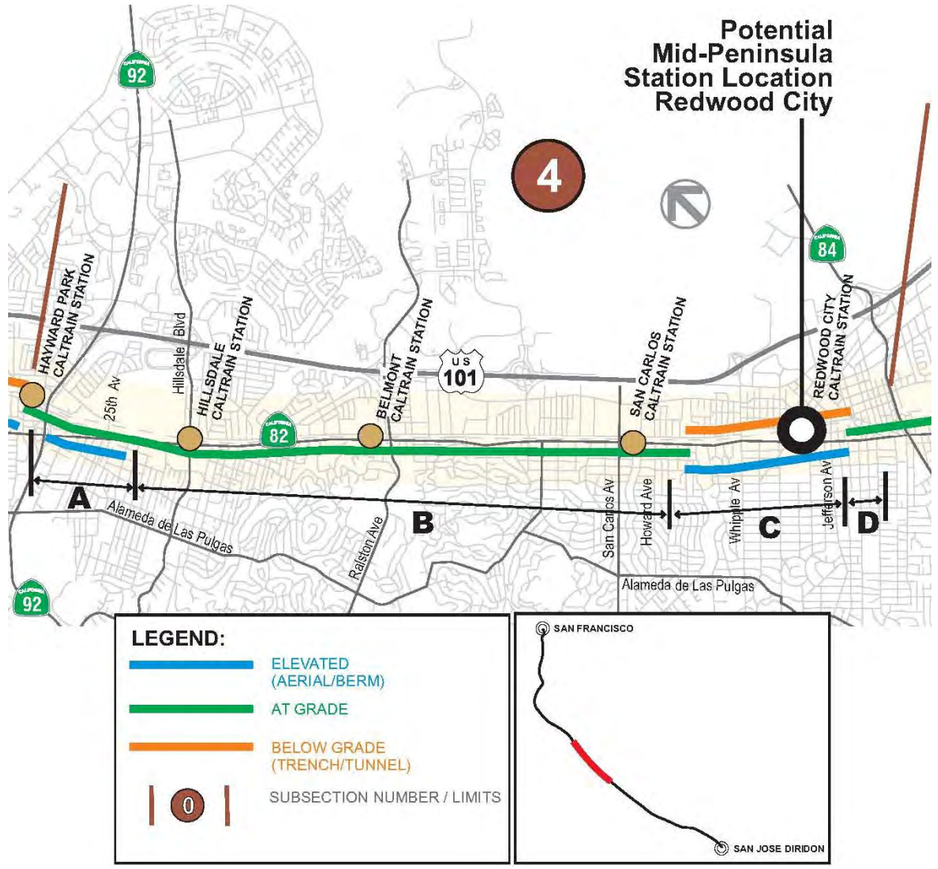
This subsection is located in the Cities of San Mateo, Belmont, San Carlos and Redwood City. For most of the northern portion of this subsection, the existing Caltrain tracks are on a recently constructed embankment that passes over the cross streets. In the southern portion of this subsection the Caltrain tracks pass through a number of at-grade crossings in downtown Redwood City. There is an existing 4 track segment at the southern end of this subsection. The existing Caltrain grade option (including widening of the existing embankment section) was carried forward throughout the subsection except in the vicinity of downtown Redwood City. In this area (subsection 4C), the existing Caltrain grade option was dropped because of the need for substantial property acquisitions to grade separate the street crossings. The elevated and below grade options were carried forward south of Howard Avenue, except in the southerly 4 track section. Around 25th Avenue in San Mateo, the below grade option was constrained by Fiesta Creek. The summary of the evaluation is presented in Table 3-7 and Figure 3-10.

Note that the alternatives carried forward in this section were later revised as a result of agency and public comment. See Section 3.3.5.

Table 3-7
Initial Review of Vertical Options – Subsection 4

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
4A	19.29	North of Highway 92			
		Elevated	✓		
		At Grade	✓		
		Below Grade		✓	Transition too short, unable to clear Hayward Park Caltrain station; conflict with Fiesta Creek
4B	19.97	South of 25th Street			
		Elevated		✓	Streets already grade-separated
		At Grade	✓		
		Below Grade		✓	Streets already grade-separated
4C	24.71	South of Cordilleras Creek			
		Elevated	✓		
		At Grade		✓	Building closely spaced downtown Redwood City road crossings under or over RR would cause significant community disruption and property acquisition
		Below Grade	✓		
4D	26.28	North of Woodside Road			
		Elevated		✓	No street crossings; conflict with Dumbarton wye
		At Grade	✓		
		Below Grade		✓	No street crossings; conflict with Dumbarton wye

Figure 3-10
Subsection 4 – Vertical Alignment Options



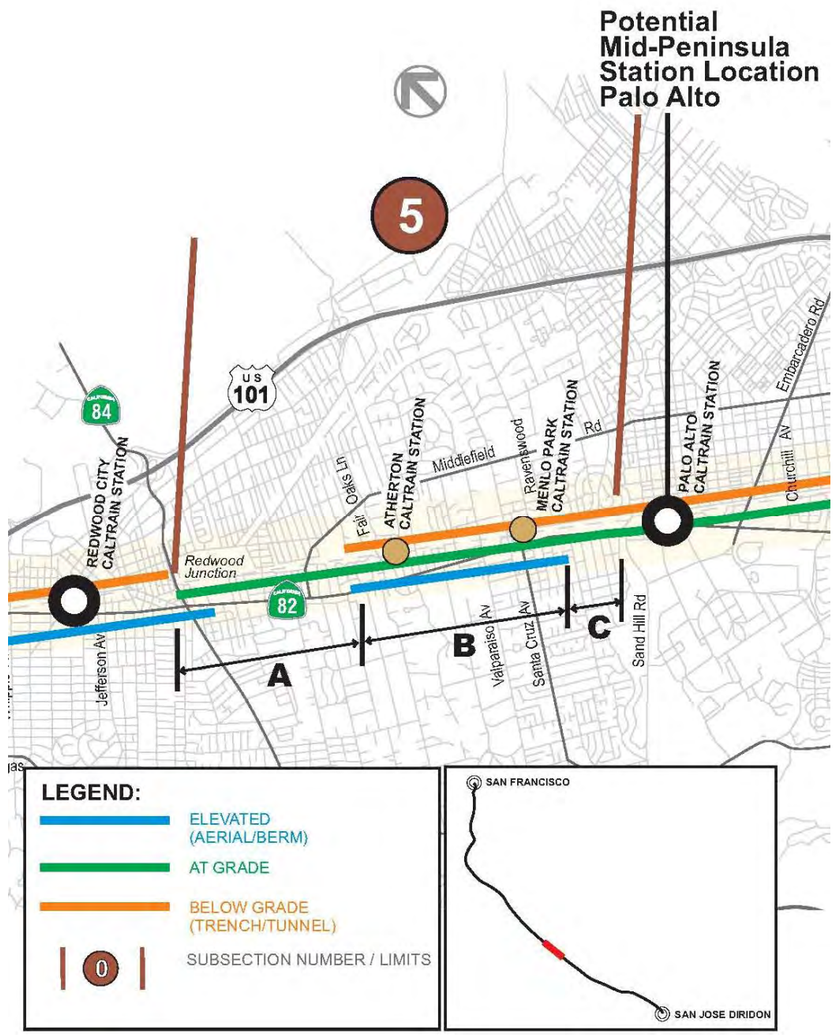
Subsection 5 – North of 5th Avenue to North of San Mateo County / Santa Clara County Line

This subsection is located in the Town of Atherton and the City of Menlo Park, with a small portion in unincorporated San Mateo County. The Caltrain tracks are at-grade, and with the exception of 5th Avenue, all street crossings are at-grade. Generally, the streets that cross the tracks are two-lane collectors serving residential areas. In most cases, these streets are integral parts of the local street network. There is an existing 4 track segment and several freight rail connections at the northern end of this subsection near Redwood Junction. Except for this area and the short subsection 5C, all three options were carried forward. The summary of the evaluation is presented in Table 3-8 and Figure 3-11.

Table 3-8
Initial Review of Vertical Options – Subsection 5

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
5A	26.88	North of 5th Avenue			
		Elevated		✓	Streets already grade-separated
		At Grade	✓		
		Below Grade		✓	Streets already grade-separated
5B	27.64	South of 5th Street			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		
5C	29.35	South of Ravenswood Avenue			
		Elevated		✓	No cross streets
		At Grade	✓		
		Below Grade	✓		

Figure 3-11
Subsection 5 – Vertical Alignment Options



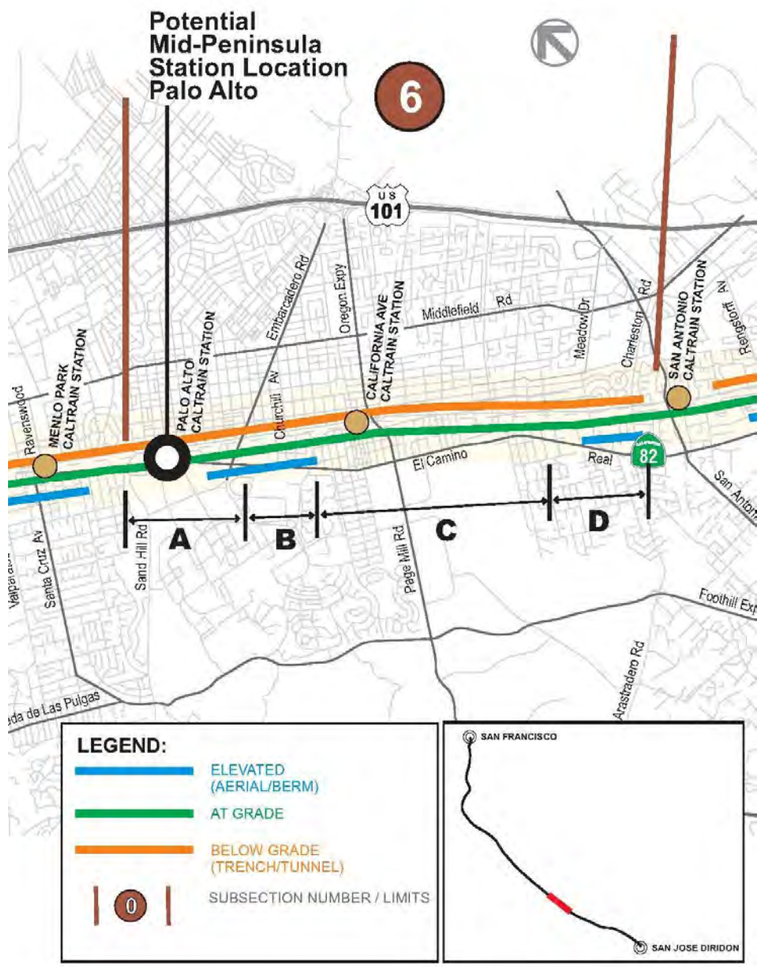
Subsection 6 – North of San Mateo County / Santa Clara County Line to North of Adobe Creek

This subsection is located in the City of Palo Alto. The Caltrain tracks are at-grade and all of the streets that are grade-separated pass under the tracks. Several at-grade crossings occur between the grade separations. Alma Street runs alongside the Caltrain tracks for the entire length of this subsection. The existing Caltrain grade and below grade options were carried forward for this entire subsection. The elevated option was carried forward from Homer Avenue to Churchill Avenue (subsections 6A and 6B) and from East Meadow Drive to Charleston Road (subsection 6D). The summary of the evaluation is presented in Table 3-9 and Figure 3-12.

Table 3-9
Initial Review of Vertical Options – Subsection 6

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
6A	29.72	North of San Mateo County / Santa Clara County Line			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		
6B	30.94	South of Embarcadero Road			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		
6C	31.63	South of Churchill Avenue			
		Elevated		✓	Streets already grade-separated
		At Grade	✓		
		Below Grade	✓		
6D	33.04	North of East Meadow Drive			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		

Figure 3-12
Subsection 6 – Vertical Alignment Options



Subsection 7 – North of Adobe Creek to North of Fair Oaks Avenue

This subsection is located in the cities of Mountain View and Sunnyvale. The Caltrain tracks are at-grade and all grade-separated crossings pass over the tracks. Several at-grade crossings occur between the grade separations. Central Expressway and Evelyn Avenue run alongside the Caltrain tracks for a large portion of this subsection. Existing aerial roadway structures crossing above the tracks constrain the elevated option through portions of this subsection. The elevated option was carried forward near the existing at-grade crossings at Rengstorff Avenue, Castro Street and Mary Avenue. The below grade option was carried forward between Rengstorff Avenue and Castro Street, and between Mary Avenue and Sunnyvale Avenue. The existing Caltrain grade option was carried forward throughout the subsection. The summary of the evaluation is presented in Table 3-10 and Figure 3-13.

Table 3-10
Initial Review of Vertical Options – Subsection 7

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
7A	33.61	North of Adobe Creek			
		Elevated		✓	Precluded by existing San Antonio Road structure
		At Grade	✓		
		Below Grade		✓	Conflict with Adobe Creek
7B	34.65	North of Rengstorff Avenue			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		
7C	36.54	North of Stevens Creek			
		Elevated		✓	Precluded by existing SR-85, Whisman and SR-237 aerial structures
		At Grade	✓		
		Below Grade		✓	Streets already grade-separated
7D	37.66	South of SR-237			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		

Figure 3-13
Subsection 7 – Vertical Alignment Options

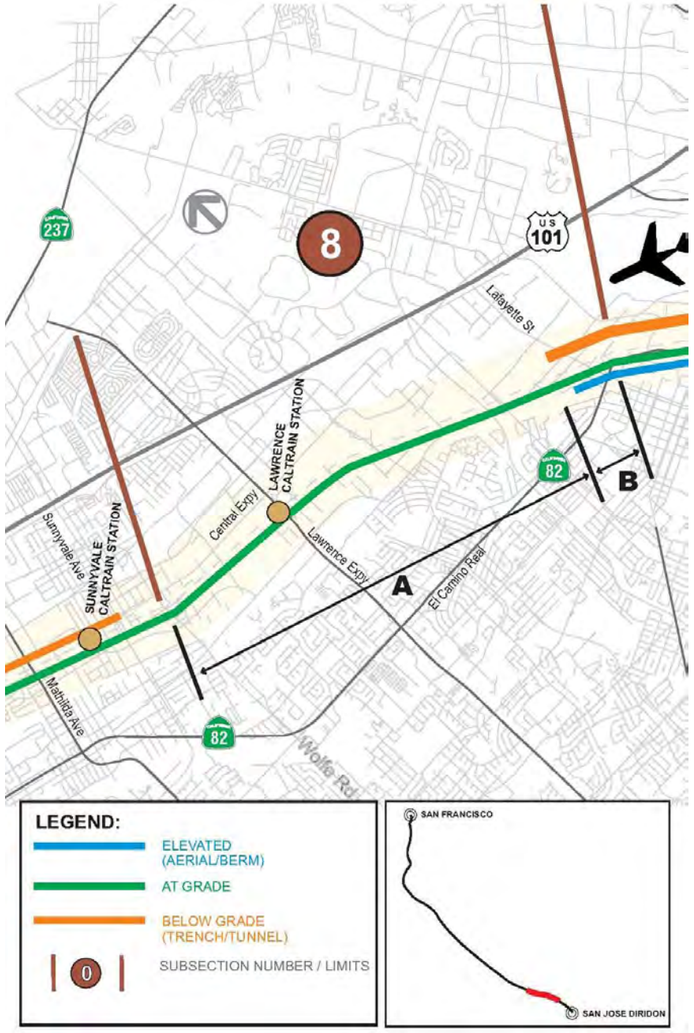
Subsection 8 – North of Fair Oaks Avenue to North of De La Cruz Boulevard

This subsection is located in the cities of Sunnyvale and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade-separated. Most of the crossings pass over the tracks. This subsection includes an existing 4-track segment near Lawrence Expressway. The existing Caltrain grade option was carried forward throughout the subsection. In the short subsection 8B, all options were carried forward for compatibility with subsection 9. The summary of the evaluation is presented in Table 3-11 and Figure 3-14.

Table 3-11
Initial Review of Vertical Options – Subsection 8

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
8A	39.29	North of Fair Oaks Avenue			
		Elevated		✓	Streets already grade-separated
		At Grade	✓		
		Below Grade		✓	Streets already grade-separated; disrupts freight access
8B	43.47	South of Scott Boulevard			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		

Figure 3-14
Subsection 8 – Vertical Alignment Options



Subsection 9 – North of De La Cruz Boulevard to San Jose Diridon Station

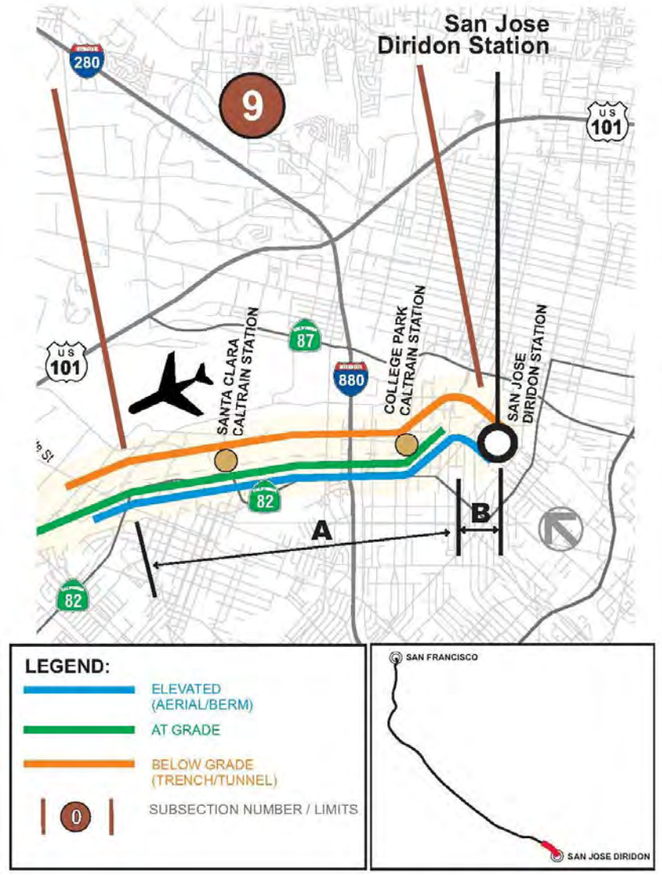
This subsection is located in the cities of Santa Clara and San Jose. The Caltrain tracks are at-grade and all crossings are grade-separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection, primarily in a tunnel. All three options were carried forward in this subsection, though the new alignment would be constructed for HST only. Caltrain would continue to use tracks in the existing corridor.

At the south end of this subsection, adjacent to the existing San Jose Diridon station, two sub-options were considered – (a) HST station over the existing station and (b) HST station on a new alignment east of the existing station. Sub-option (b) was included to conform with alignment alternatives being evaluated in the San Jose to Merced section Alternatives Analysis. Sub-option (b) will be modified or dropped depending on decisions made regarding the San Jose to Merced alignment. For sub-option (a) only the elevated option was carried forward since the construction of an underground station below Caltrain would be difficult and disruptive to current rail operations. For sub-option (b) the elevated and below grade options were carried forward. For both sub-options the at-grade alternative was dropped since it would require substantial new right-of-way and cause community disruption. The summary of the evaluation is presented in Table 3-12 and Figure 3-15.

Table 3-12
Initial Review of Vertical Options – Subsection 9

Sub-section	Mile Post	Proposed HST Grade Relative to Existing Caltrain Grade	Alternative Carried Forward	Alternative Removed From Consideration	Basis for Removal
Subsection 9(a) HST Station Over Existing Caltrain Station					
9(a)A	44.04	North of De La Cruz			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		
9(a)B	46.31	South of Taylor Street			
		Elevated	✓		
		At Grade		✓	Substantial community disruption and relocation
		Below Grade		✓	Requires deep HST station under existing Diridon station tracks
Subsection 9(b) New HST Station East of Existing Caltrain Station					
9(b)A	44.04	North of De La Cruz			
		Elevated	✓		
		At Grade	✓		
		Below Grade	✓		
9(b)B	46.31	South of Taylor Street			
		Elevated	✓		
		At Grade		✓	Substantial community disruption and relocation
		Below Grade	✓		

Figure 3-15
Subsection 9 – Vertical Alignment Options



3.3.4 Agency Coordination and Public Outreach

Early Outreach and Scoping

Initial outreach activities were conducted with key decision makers, agency representatives, businesses, environmental groups and community leadership throughout the San Francisco to San Jose project corridor beginning in November 2008 and continued through mid-January 2009. As the scoping period began, three meetings were held between January 22 and January 29, 2009 in San Francisco, San Mateo and Santa Clara counties. In an effort to provide additional opportunities for agency and public input, various briefings and three project information meetings were also held in Millbrae, Redwood City and Palo Alto (between February and March 2009). Detailed information about the scoping (and other coordination meetings) was documented in the draft San Francisco to San Jose Scoping Report (June 2009 and updated in August 2009).

Development of Initial Options

The following paragraphs summarize the results of outreach activities during development of the initial alternatives. Detailed discussion of the outreach activities and summaries of the input provided at each event are included in Appendix F.

Technical Working Groups – Meeting #1: To enhance outreach and coordination efforts related to the assessment of the proposed alternatives (and other municipal, land use, planning, and regulatory/permitting considerations) a Technical Working Group (TWG) process was established in spring-2009. The initial series of Technical Working Group meetings with the city/county and transportation agency representatives was held on June 23, 2009 (in San Carlos) and the resource agency representatives meeting was held on June 26, 2009 (in San Francisco). These meetings provided an overview of the San Francisco to San Jose Section environmental process, created a forum for early engagement around alternatives options and underscored the need for ongoing collaboration between the designated resource, city/county and transportation agency representatives, as well as the project technical and outreach staff. The meetings focused on the role of the TWG in assessing technical information provided by the project team, coordination pertaining to land use planning, identifying potential physical and environmental impacts on existing assets, and identification (and recommendations related to mitigation) of potential community impacts and current conceptual alternatives options.

Some of the comments provided by the TWG agency representatives during the first set of meetings included:

- Encourage close coordination with emergency response personnel
- Suggest close coordination with the San Jose to Merced HST section, as several creeks in that segment could potentially be impacted by the San Jose to San Francisco section
- Important to fold in context sensitive design and transit art programs early in the process
- Address hazmat, seismic considerations, and flooding issues as part of the analysis

As a result of these meetings, the regional team began to investigate context sensitive approaches, and hold technical work sessions on life safety considerations.

Authority Meetings to Review Initial Alternatives:

The results of the initial alternatives review were presented in a meeting conducted by the Authority on July 6, 2009, and in a follow-up meeting on August 28, 2009. As a result of these meetings, it was re-confirmed that the basic configuration for the San Francisco to San Jose section be four tracks operated as an integrated mixed use railroad serving HST and Caltrain, with freight service operating between midnight and 5:00 AM under special operating conditions. See Section 4.1.2.

Review of Initial Alternatives

Individual Agency Meetings: The engineering and station area design teams conducted one-on-one meetings with available city and county staff within the San Francisco to San Jose project corridor in September 2009. During the one-on-one meetings, there were some instances where existing overcrossings thought to be 'fixed objects not worthy of modification', such as Shoreline Boulevard in Mountain View, Woodside Road (State Route 84) in Redwood City, and Oregon Expressway in Palo Alto, were identified as possibilities to be converted to an at-grade configuration to restore the original street network if the rail alignment were to be elevated. There were additional vertical alignment options that were requested to be investigated in the Belmont/San Carlos area and Redwood City/San Mateo.

The Belmont/San Carlos cities requested that a below-grade vertical option (for the HST) be studied in addition to converting the existing berm configuration to a higher viaduct configuration such that the existing grade-separated road profiles could be flattened and allow for increased sight lines. In Mountain View and Redwood City, each city has an existing overcrossing (bridge over the Caltrain Corridor) that was requested to be investigated for conversion to at-grade (to restore the original street network) if an elevated rail alignment option was continuing to be studied. In a conversation with the County of Santa Clara regarding their expressway network and current grade separations with the Caltrain Corridor, Oregon Expressway in Palo Alto was identified for possible conversion to at-grade from the existing below-grade configuration. The County has experienced increased maintenance and stormwater contamination problems with this undercrossing.

In general, the cities expressed a strong desire to eliminate the berm/embankment option in favor of a viaduct option should an elevated alignment be studied. The cities noted that for this type of vertical option, reuse (for additional roadway crossings/connections, bike paths, landscaping, retail/commercial use) of the area below a viaduct should be investigated.

Technical Working Groups – Meeting #2: The project team met for a second time in September 2009 with the TWG representatives. The focus of these meetings was to assess the current alternatives options and gather additional input from the resource, city/county, and transportation agency representatives. Comments provided by the TWG agency representatives included:

- Drainage channels should be shown as constraints on the map exhibits
- Specify how would Caltrain be kept operational during construction
- Concerned about the operational considerations of shared tracks
- Explain why the 101 and 280 corridor alternatives were rejected earlier as part of the program EIR/EIS process
- Explain how freight rail would be incorporated into the project
- Proposition 1A mandated that the only San Francisco HST stop would be at the Transbay Terminal
- Several options being evaluated in San Francisco have already been rejected by TJPA
- Specify the life safety features for each vertical alignment option, including ventilation for trench and tunnel options.

Open Houses: Three county-specific alternatives analysis public meetings were held in San Carlos (San Mateo County) on September 30, 2009, Sunnyvale (Santa Clara County) on October 9, 2009 and San Francisco (San Francisco County) on October 13, 2009. These meetings provided a forum for additional outreach and opportunities to discuss issues, questions and comments relative to the alternatives analysis process. Comments received at the San Carlos Open House included:

- Is there a way to construct the HST without requiring extra right-of-way for shoofly tracks?
- HST is not needed on Peninsula because of existing service
- Alternatives need to be evaluated system wide and should not switch between vertical alignments along corridor
- Provide a full cost analysis for each alignment option
- Continue to study the no-build option

- Include development opportunities above tunnel or under structures
- Consider freight rail use, increased capacity and rail car heights
- Show the horizontal right-of-way
- Subsection 3 should be entirely underground
- What will be the impacts to the Hetch-Hetchy water pipe in Palo Alto at the Alma Street crossing in subsection 6?
- How will four tracks fit at the Holly Street transit village in subsection 4?
- Consider the potential expansion of Palo Alto High School into Caltrain/HST ROW for playing fields if tunnel option is selected.
- Preserve the Green Meadow neighborhood near Charleston Avenue in subsection 7, it is a nationally registered historic site
- 5th Avenue in Atherton to San Antonio Road in Palo Alto should be tunneled.

Comments received at the Sunnyvale Open House included:

- The elevated option would impact views of the eastern foothills
- Pedestrian and Bicycle access should be available at ½ mile at intervals
- Impacts to groundwater and underground creeks should be evaluated for all trench options
- With regard to environmental justice, it is important to treat all segments and communities equally when determining the best vertical alignment option
- Lumping trench, cut & cover tunnel, and mined tunnel together as the "below-grade option" is misleading, as each below grade option has different constructability issues
- Evaluate the new property values created if the HST system was tunneled
- The Mountain View station and rail should be tunneled or trenched
- Palo Alto is the only reasonable site for a mid-peninsula station because it is currently Caltrain's #2 station for ridership
- The current vibration problems with Caltrain will be exacerbated by HST
- Please consider dense landscaping to block any retained fill on the elevated options.
- A priority for alternatives along subsections 9(a) and 9(b) should be pedestrian and bicycle access for neighborhoods west of Caltrain tracks and Diridon station

Comments received at the San Francisco Open House included:

- How will noise impacts be mitigated near the maintenance yard?
- Visual impacts from the maintenance yard and its potential to divide residential neighborhoods from the bay are a concern
- Vertical alignment impacts to animal migration and to the seasonal wetlands used by migratory birds along the Brisbane Baylands are important to consider
- Leave track at-grade and lower streets
- The Beale Street option, subsection 0d, disrupts more residential neighborhoods than other options.
- The Beale Street option, subsection 0d, does not connect passengers to other existing transit options. The Beale Street, subsection 0d, option does not conform to the policies adopted by TJPA and the City & County of San Francisco

Policymaker Working Group - Meeting #1: A Policymaker Working Group (PWG) was also established in order to invite the collaboration and input of elected officials (and their designated representatives) in the environmental process, provide opportunities for coordination with TWG representatives and facilitate additional interface with the project technical and outreach staff. The initial meeting with the elected official's representatives was held on October 15, 2009 in San Carlos and provided an overview of the project corridor's environmental process, and a discussion regarding the alternatives analysis process. Comments provided by the PWG representatives included:

- Clarify if the below grade option would require eminent domain
- Millbrae expressed concern about 4-track system affecting local development plans
- Consider connecting both sides of the tracks in subsection 4 to create community access linkages (but noted with this configuration safety/security needed to be factored in as well)

Cities of Palo Alto, Menlo Park, and Town of Atherton Design Workshop: The Cities of Palo Alto, Menlo Park and the Town of Atherton convened a two-day design workshop on October 3-4, 2009 to discuss issues, concerns and ideas related to the HST EIR/EIS process. Approximately 80 interested participants attended, comprised of residents and planning and transportation professionals. The major topics addressed at the workshops included: quality of life, community connections, and minimizing impacts to historic and cultural resources, the environment and communities. Recommendations and comments included:

- Place HST in a bored tunnel along the 8-mile rail corridor; this was the unanimous recommendation by the eight neighborhood break-out groups at the workshop.
- Tunneling offers the best option for both reconnecting and enhancing the quality of life in the communities and minimizes the impact of the HSR environmentally, visually, and culturally.
- Connect the east and west sides of the communities.
- Traffic movement needs to be designed in each community; interchanges and intersection improvements must be made with the rail improvements.
- There were not any strong recommendations for/against a HST station on the Peninsula; however if it is decided to put one in Palo Alto, multi-modal transportation must connect to the station, and some recommended there be minimal or no parking, with drop-off only. Other options include a station with car share, bike and car rentals, and transit hub.
- Historic trees, bridges, buildings, creek areas should not be impacted by HST.

- With a tunnel, the newly connected communities can include a huge greenway: parks, athletic fields, gardens, art sculptures, and bike and pedestrian paths. Cities can include new senior citizen centers, cultural and community centers, and city halls.

Letters Received during AA Process: Letters received from citizens and organizations included the following comments:

- Because of safety issues, visual and noise impacts, and property value impacts the entire HST and Caltrain system should be underground.
- Burlingame should be trenched to maintain the historic (1896) Burlingame train station.
- Sites identified as "Historic Resources" should be maintained and not relocated.
- Subsidiary project objectives need to be established that include retail development under elevated trains in commercial areas, and beautification and landscaping efforts as a high priority in residential neighborhoods.
- The "No-Build" Alternative is preferred.
- San Jose to San Francisco travel should be accommodated on the existing Baby Bullet trains.
- Consider tunnel option for Alma Street in Palo Alto.
- Subsection 5 should all be tunneled with UPPR freight services on top; this would avoid the required 10 grade separations.
- Tunneling subsection 7 would allow reclaimed land to be used for parks, native vegetation.
- Tunneling subsection 7 would reduce noise and would have less of a visual impact.
- Tunneling subsection 7 would be safer, reduce traffic congestion, and maintain existing easements.
- Elevated trains along subsection 5 will lead to graffiti and decreased tax revenue from the loss of small business along the alignment.
- Concerned about east/west connectivity in subsection 5.
- Request eminent domain not be used. If necessary, residents would like to see the pricing mechanism that will be used before eminent domain is exercised.
- Request re-study of the 101-corridor as the HST alignment.

Comments Submitted by Agencies: Letters received from cities and other governmental agencies included the following comments:

- AC Transit:
  - Requests removal of the Beale Street terminal as shown in subsection 0(d)
  - Requests an analysis of ridership demands on AC transit service for the San Mateo bridge and Dumbarton bridge crossings
  - Requests an analysis of ridership demands on AC Transit from HST services, specifically at San Francisco stations and a Palo Alto station
  - Requests an analysis of transit-specific mitigations to minimize delays to transit during construction and operation of the HST system
- City of Menlo Park
  - Formally chooses below-grade as its preferred alternative
  - Railroad grades should not be limited to 1%
- San Francisco Planning Department
  - Formally rejects the Beale Street alignment, shown in subsection 0d, as not feasible.
  - Caltrain crossings at 16th Street and Mission Bay Drive are very important to connectivity and movement of goods for the Mission Bay area.
- City of San Mateo
  - Grade separations must be completed at the 28th and 31st Avenue crossings to maintain east/west connectivity.
  - Consider relocation of the Hillsdale Caltrain station.
  - Consider Bay Meadows Phase II Development for TOD
  - Residents have raised concerns regarding noise and visual impacts

Selection of Options to be Carried Forward into Detailed Evaluation

In consideration of design constraints and conflicts, and environmental impacts and benefits for each alternative, the following approaches to the further development of alternatives were established:

- At-grade options should be carried forward whenever possible to meet the purpose and need objective of minimizing capital cost and the constructability objectives of maintaining Caltrain service during construction and maintaining freight rail service when the project is completed.
- Deep (bored) tunnel options that include a station will be avoided because such a configuration presents constructability problems and would be exorbitantly expensive failing to meet the objective of minimizing capital cost. Deep tunnel options that do not include a station will be considered, including options where only HST would be in a deep tunnel and Caltrain and freight would be in another vertical configuration.
- High berms (see definition in Section 4.1.1) will not be carried forward in commercial or residential areas where a berm would divide communities either visually or physically by unduly constraining pedestrian, bicycle and vehicular movement across the railroad corridor.
- Where sufficient right-of-way is available, aerial viaduct options should generally be twin 2-track structures with a gap between them to provide light to the area under the structures.

Context Sensitive Solutions Workshop: A workshop and presentation introducing the Contest Sensitive Solutions (CSS) approach were held on November 4, 2009 in Burlingame. As described in Section 2.5, CSS is a

collaborative process that involves interested parties in arriving at design solutions that are sensitive to community concerns while also supportive of the objectives of the project. The Authority is committed to following the CSS process as the Alternatives Analysis and EIR/EIS move forward. Subsequent to this workshop, the CSS team has developed a summary of values, issues, goals, and opportunities gathered from the CSS workshop. See Appendix F.

3.3.5 Options Carried Forward and Not Carried Forward into Detailed Evaluation

As a result of comments received from local agencies and the public, several of the initial vertical options originally identified for removal were retained for further evaluation. Other options identified for removal were retained as a result of further refinements to the conceptual engineering alignment profile and the location of transitions from one option to another. Profile refinements and engineering analysis also resulted in removal of a few options originally indentified for further evaluation:

- In subsection 0(c)A, the Below Grade option was dropped, due to technical infeasibility (See the discussion of Alternative 4 in Appendix H)
- In subsections 1A and 1B, the At Grade option was retained due to profile refinements
- In subsection 3A, the Elevated option was retained to be consistent with the transition from a below grade HST-only alignment at the Millbrae intermodal station
- In subsections 4B, 4D, and 5A, the Below Grade option was retained at the request of Belmont and San Carlos (see the Individual Agency Meetings discussion in Section 3.3.4)
- In subsections 4B, 4D, and 6C the Elevated option was retained due to refinements of vertical profile transitions
- In subsections 7A and 7B, the Elevated and Below Grade options were retained due to refinements of vertical profile transitions
- In subsection 9(b)A, the Elevated and At Grade options were dropped due to profile refinements by the San Jose to Merced regional team
- In subsection 9(b)B, the Elevated option was dropped due to profile refinements by the San Jose to Merced regional team

Table 3-13 lists the options by subsection that were carried forward (with a checkmark) and those that were not carried forward (no checkmark). Schematic diagrams of the options appear in Section 4.

Table 3-13
Options Carried Forward

Sub-section	Beginning Mile Post	Beginning Subsection Limit	Existing Caltrain Station Location	Potential HST Station Location	HST Options Carried Forward		
					Elevated	At Grade	Below Grade
0(a)A	n.a.	n.a.	4th & King	San Francisco			✓
0(b)A	n.a.	n.a.	4th & King	San Francisco			✓
0(c)A	n.a.	n.a.	4th & King	San Francisco		✓	
0(d)A	n.a.	n.a.	4th & King	San Francisco			✓
1A	1.03	North of Mission Bay Drive				✓	✓
1B	1.32	South of 16th Street	22nd Street			✓	✓
1C	2.07	South of 23rd Street				✓	✓
1D	2.29	North of Cesar Chavez Street				✓	✓
1E	3.21	South of Quint Street				✓	✓
1F	3.87	North of Williams Street				✓	✓
1G	4.36	South of Paul Avenue				✓	✓
2A	5.77	South Portal Tunnel No. 4	Bayshore			✓	
2B	9.93	South of Colma Creek	So. San Francisco		✓	✓	
2C	10.96	South of I-380			✓	✓	✓
2D	13.20	South of Center Street	Millbrae	Millbrae		✓	✓
3A	14.38	South of Millbrae Avenue	Broadway, Burlingame		✓	✓	✓
3B	15.14	South of Mills Creek			✓	✓	✓
3C	17.04	North of Villa Terrace			✓		✓
3D	17.84	North of San Mateo station	San Mateo		✓		✓
3E	18.83	North of Hayward Park station	Hayward Park			✓	
4A	19.29	North of Highway 92			✓	✓	
4B	19.97	South of 25th Street	Hillsdale, Belmont, San Carlos		✓	✓	✓
4C	24.71	South of Cordilleras Creek	Redwood City	Redwood City	✓		✓
4D	26.28	North of Woodside Road			✓	✓	✓
5A	26.88	North of 5th Avenue				✓	✓
5B	27.64	South of 5th Street	Atherton, Menlo Park		✓	✓	✓
5C	29.35	South of Ravenswood Avenue				✓	✓
6A	29.72	North of San Mateo County/Santa Clara County Line	Palo Alto	Palo Alto	✓	✓	✓
6B	30.94	South of Embarcadero Road			✓	✓	✓
6C	31.63	South of Churchill Avenue	California Ave.		✓	✓	✓
6D	33.04	North of East Meadow Drive			✓	✓	✓
7A	33.61	North of Adobe Creek	San Antonio		✓	✓	✓
7B	34.65	North of Rengstorff Avenue	Mt. View	Mt. View	✓	✓	✓

Sub-section	Beginning Mile Post	Beginning Subsection Limit	Existing Caltrain Station Location	Potential HST Station Location	HST Options Carried Forward		
					Elevated	At Grade	Below Grade
7C	36.54	North of Stevens Creek Blvd.			✓	✓	✓
7D	37.66	South of SR-237	Sunnyvale		✓	✓	✓
8A	39.29	North of Fair Oaks Avenue	Lawrence			✓	
8B	43.47	South of Scott Boulevard			✓	✓	✓
9(a)A	44.04	North of De La Cruz	Santa Clara, College Park		✓	✓	✓
9(a)B	46.31	South of Taylor Street	San Jose Diridon	San Jose Diridon	✓		
9(b)A	44.04	North of De La Cruz	Santa Clara, College Park				✓
9(b)B	46.31	South of Taylor Street	San Jose Diridon	San Jose Diridon			✓

4.0 Development and Evaluation of Project Alternatives

The alignment design options carried forward from the initial review of alternatives were further developed in engineering design and were assessed using the evaluation measures described in Section 2. This section describes the development of the alternatives and presents the results of applying the evaluation measures to the design options.

4.1 Description of Alternatives

Ongoing conceptual engineering during public review of the initial alternatives provided additional details regarding configuration of the design options. As described below, these details fell into two categories:

- expanded definitions of the vertical options
- alternative arrangements for the tracks and Caltrain station platforms within the ultimate project right-of-way.

4.1.1 Definition of Vertical Options

For the detailed evaluation of alternatives, the three basic vertical options have been expanded to six options to better differentiate their characteristics. It is important to note that the transitions between these various vertical options (from at-grade profile to an elevated profile for example) require the use of berms or mechanically stabilized earth (MSE) to complete the transition to an aerial viaduct. These transition areas will be better defined in the Draft EIR/EIS.

- Elevated Option
    - Aerial Viaduct – typically a concrete structure supported by columns. This type of solution would usually be appropriate for structures greater than 10 feet above the current rail grade level.
    - Berm – typically earth fill within retaining walls, mechanically stabilized earth (MSE) but could also be earth fill with 2:1 side slopes. There are two types of berms and this option typically refers to the "High Berm":
        - High Berm (greater than 10 feet) would be used for elevating the railroad over the existing street network, such as the elevated section of Caltrain through Belmont and San Carlos or the planned grade separation project through San Bruno. For this alternatives analysis the "high berm" is what is being described as a possible option for the elevated portions of the Caltrain corridor.
        - Low Berms (less than 10 feet) would be used for transitions to and from aerial viaduct for elevated portions of the railroad and are considered in the at-grade option.
- Existing Caltrain Grade
    - At Grade – typically at the level of the surrounding ground surface, but sometimes elevated or below grade if that is the configuration of the existing Caltrain tracks. Much of the Caltrain alignment that is "at-grade" is on a low berm several feet off the ground. A good example of this is the stretch of railway between Atherton and Menlo Park where, the actual railway level varies from "at-grade" at the Atherton station, to a "low berm" at Encinal Ave, as the railway travels south to Menlo Park. This is because the railroad remains at a constant grade while the surrounding ground level undulates.
- Below Grade
    - Open Trench – typically in a cut with retaining walls. The cut would be deep enough for a cross street to pass over the tracks without raising the elevation of the street.
    - Covered Trench/Tunnel – typically a trench covered with a deck to allow streets or other uses above the tracks. Generally, the cover would not be continuous in order to allow ventilation of the track area. Mined tunneling could also be used for short distances in shallow areas to minimize surface disruption.
    - Deep Tunnel – typically a bored tunnel with ventilation shafts space appropriately.

4.1.2 Train Operations and Arrangement of Tracks and Station Platforms

In 2004, the Authority published an operations report that described, at a conceptual level, the statewide system configuration for HST as a two main track system to support its service pattern, with four track sections at stations to accommodate both stopping and run-through trains. This description (two mainline tracks and four track sections at stations) included the San Francisco to San Jose Section.

Caltrain currently operates commuter rail service on a two main track system with several four track sections to allow express trains (Baby Bullet service) to overtake local trains (trains making frequent, multiple station stops). To accommodate the estimated capacity requirements needed to support both HST and Caltrain projected services, a four main track system is currently assumed for this corridor. The San Francisco to San Jose Section is considered to be a "shared use" corridor between Caltrain and HST, allowing each operator access to the four (assumed) main line tracks in order to reliably deliver their respective schedules and service types.

At this time the HST Phase 1 Operating Plan and the Caltrain Draft 2025 service plan timetable have not been fully integrated into a single operating plan for the entire Peninsula corridor, though a conceptual operations analysis of the northern end of the corridor has been prepared to evaluate the San Francisco terminal options (see Appendix K). The conceptual and preliminary engineering being developed as part of this Alternatives Analysis process will be the basis for a simulation model that will be the primary analytical tool to refine these service plans and produce a fully integrated operating plan, accounting for both of the train services on the Peninsula. It is anticipated that this future modeling will further validate the need for the four main tracks assumed for the Peninsula Corridor by refining train schedules demonstrating the feasibility of providing reliable service within the joint operating concept.

The 2035 service assumptions are as follows:

- Service Frequency
    - HST will operate up to 10 trains per hour in each direction (8 trains per hour in the 2030 Phase 1 Operating Plan, plus an allowance for 2 additional trains per hour when the full system serves Sacramento and San Diego), with system capacity of up to 12 trains per hour in 2035.
    - Caltrain will operate up to 10 trains per hour in each direction (per the Caltrain Draft 2025 timetable)
- Station Stops
    - HST will stop at San Jose Diridon, Millbrae and a Downtown San Francisco location. A potential additional Mid-Peninsula station is under consideration either at Redwood City, Palo Alto or Mountain View
    - Caltrain will provide service to existing stations
- Operating Pattern
    - HST will operate a mix of express trains that would not stop between San Jose and San Francisco and other trains that would stop either at Millbrae, at the potential Mid-Peninsula station or at both.

  - Caltrain will operate a mix of express, skip-stop, and/or local services
- Overtakes (an overtake is one train passing another travelling in the same direction)
  - It is currently assumed in the Phase 1 Operating Plan that the HST has no scheduled overtakes between San Francisco and Gilroy
- Under normal operating conditions, HST is assumed to operate predominantly on two mainline tracks and Caltrain is assumed to operate predominantly on the other two mainline tracks. Crossovers connecting the four mainline tracks will be placed at specified intervals/locations to provide for commingling of trains for "shared operations" on the same tracks when necessary.

Several different 4-main line track concepts are under consideration in the San Francisco to San Jose Section. There are several key attributes that contribute to the effectiveness of each proposed configuration concept:

Caltrain Platform Placement: Caltrain would use either side platforms with access to only one track (northbound or southbound) or center platforms with access to two tracks.

Station Access for Caltrain Passengers: At most existing Caltrain stations, the primary access to the tracks is from the west side of the corridor. This typical configuration is reflected in the locations of town centers, existing historic train depots, parking, and bus and taxi access relative to the existing Caltrain platforms.

Rail Crossovers During Passenger Service: At the higher speeds (up to 125 miles per hour) and higher train frequencies (up to 20+ trains per hour) anticipated for both HST and Caltrain service, it is not operationally feasible for trains to cross oncoming rail traffic to reach another track and maintain reliable service performance. Instead, a railroad grade separation must be provided to physically separate the crossing movement from the opposite-running track. This situation is analogous to an automobile attempting to pass a slow moving truck on a busy two-lane highway; if the volume and speed of oncoming cars are too high, there will not be enough gaps in the oncoming traffic to allow a safe passing maneuver.

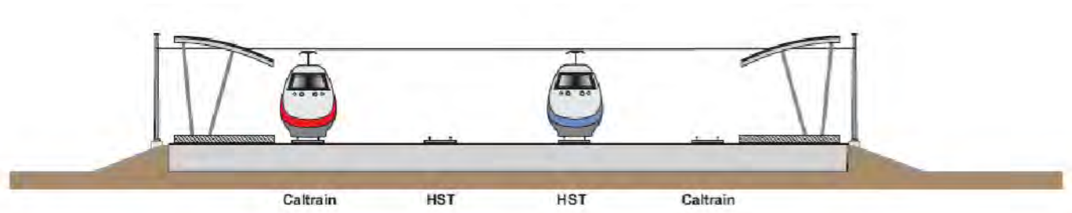
Rail Crossovers During Freight Service Operation: The existing freight "spurs" along the corridor will be served by freight trains operating on the corridor between midnight and 5:00 AM under special operating conditions. The combination of fewer trains and lower speeds during these hours means that train movements on all tracks and in both directions could be made at-grade, however, railroad grade separations may be required at certain locations.

The four main tracks can be configured in several ways and these concepts can be grouped into two general categories. The following configuration assumptions apply to "normal" operations and during minor service disruptions. When major disruptions may occur, the HST and Caltrain trains would be able to use any of the four tracks as prescribed by operational needs.

4 Tracks – Local/Express: In the typical implementation of this configuration, local Caltrain and freight trains would primarily operate on the two outer tracks and express HST trains on the two inner tracks, although the reverse arrangement is possible, with the express HST trains on the outer tracks and local Caltrain and freight trains on the inner tracks. If a minor disruption causes a track blockage, trains could be routed to the other same-direction track. For example, if the northbound local track is blocked, northbound local trains would be permitted to operate around the disabled train by temporarily switching over to the northbound express track. This reduces the potential for the blockage to affect opposing train movements.

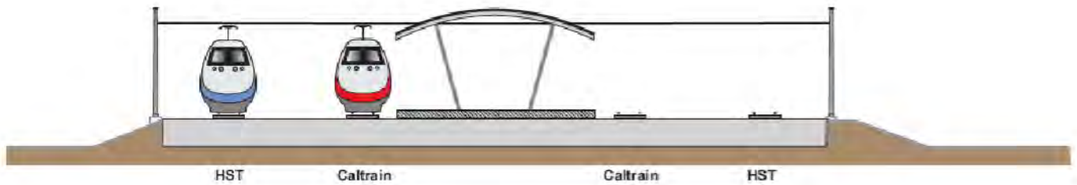
Local-Caltrain-Freight outboard/Express-HST center – this configuration would have side platforms at the Caltrain stations. Caltrain customer access would be split between the east and west sides. The existing freight spurs would have direct connections to the local Caltrain tracks. This configuration would require railroad grade separation structures to allow Caltrain to access either station platform. Figure 4-1 below illustrates a typical cross section of operations with Caltrain outboard and HST in the center.

Figure 4-1
Typical Configuration for Caltrain Outboard and HST in Center



Local-Caltrain-Freight center/Express-HST outboard – this configuration would have center platforms at the Caltrain stations. Caltrain customer access would continue to be consolidated on the westside. The existing freight spurs on both the westside and eastside would be served across the Express-HST tracks during early morning hours. This configuration would require railroad grade separation structures to allow HST to access the other HST track. Figure 4-2 below illustrates a typical cross section of operations with Caltrain in the center and HST outboard.

Figure 4-2
Typical Configuration for Caltrain in the Center and HST Outboard

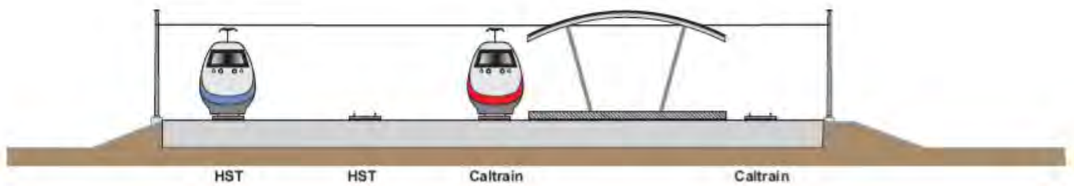


Pair of Adjacent Double Tracks: Local Caltrain and freight trains would operate on a pair of adjacent tracks and express HST trains would operate on a different pair of adjacent tracks. In this case, during a minor disruption, operations would be temporarily "single-tracked" around the blockage for either local or HST services. For example, if the northbound local track is blocked, northbound local trains would be dispatched around the disabled train by temporarily switching over to the southbound local track. This would impact the schedule of southbound local trains, but northbound and southbound HST trains would not be affected by the blockage.

Local-Caltrain-Freight westside/Express-HST eastside – this configuration would have center platforms at the Caltrain stations. Caltrain customer access would continue to be consolidated on the westside. The existing freight spurs on the westside would have direct connections to the local Caltrain tracks while the eastside spurs would need to cross the Express-HST tracks during early morning hours. No railroad grade separation structures would be needed for access between Caltrain tracks or between HST

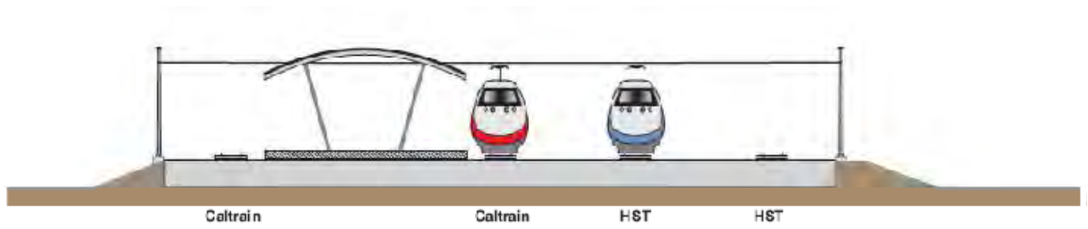
tracks. Figure 4-3 below illustrates a typical cross section of operations with Caltrain on the westside and HST on the eastside, as viewed facing southbound towards San Jose.

Figure 4-3
Typical Configuration for Caltrain Westside and HST on the Eastside



Local-Caltrain-Freight eastside/Express-HST westside – this configuration would have center platforms at the Caltrain stations. Caltrain customer access would be shifted to the eastside. The existing freight spurs on the eastside would have direct connections to the local Caltrain tracks while the westside spurs would need to cross the Express-HST tracks during early morning hours. No railroad grade separation structures would be needed for access between Caltrain tracks or between HST tracks. Figure 4-4 below illustrates a typical cross section of operations with Caltrain on the eastside and HST on the westside, as viewed facing southbound towards San Jose.

Figure 4-4
Typical Configuration for Caltrain Eastside and HST on the Westside



4.2 Evaluation Measures

Six specific categories of evaluation measures were used to analyze the alternatives:

Alignment and Station Performance Objectives and Criteria – Ridership and revenue potential, connectivity and accessibility, and operating and capital cost

Land Use – Development potential for TOD near stations, consistency with other planning efforts and adopted plans

Constructability – access for construction, disruption to existing railroads, and utility relocations

Community – Property displacements, property access impacts, and local traffic impacts

Environmental Resources – Waterways, habitats, cultural resources, and parklands

Environmental Measures – noise, vibration, visual, geologic, and hazardous materials

The summary tables that follow in Section 4.3 explain many of the evaluation measures and methods, but for some measures, additional information about the methodology is provided below.

4.2.1 Capital Cost

Capital cost (in 2009 dollars) was evaluated using conceptual estimates based on a 2-4% level of engineering development. Due to the extremely conceptual nature of the engineering drawings that were used to estimate quantities for the cost estimates, the cost estimates themselves should be regarded as very preliminary. Further development of engineering drawings to the 15% and 30% stage will result in adjustments to these cost estimates upwards and downwards.

The general scope of work included in the cost estimate is as follows:

- Guideway, track (2 track/4 track), drainage
- Earthwork (site preparation, cut, fill, borrow, spoil, security fencing, etc.)
- Structure (standard structure, waterway crossing), tunnels (2 track/4 track, drilled & blast, cut & cover, mined, bored), trenches (long/short), and walls (retaining wall, containment walls)
- Grade separations (4 lane / 2 lane / pedestrian, overcrossing / undercrossing)
- Relocation of existing tracks and utilities
- Building items (new Caltrain stations)
- Communication systems and signaling
- Traction power supply and distribution
- Program implementation costs (25%)
- Contingency (25%)

Right-of-way acquisition cost is not included in the cost estimates. Due the conceptual level of engineering development, it is not possible to estimate right-of-way quantities at this time. Instead, a qualitative assessment of potential right-of-way cost was performed, including the potential need for permanent ROW for HST, Temporary Construction Easements (TCE), and ROW for new grade separations.

It is important to note that in order to develop an appropriate and logical cost estimate, all of the 10 subsections of the San Francisco to San Jose Section need to be "stitched" together into a set of cohesive alignment alternatives covering the entire length of the corridor. This exercise will be part of the 15% design study which is currently under development. Once these corridor-wide alternatives are developed, they will be described on an engineering, environmental and cost basis. These corridor-wide alternatives can then become the basis for discussion of what is financially achievable.

4.2.2 Property Impact

Displacements: The potential impact on properties adjacent to the Caltrain corridor was qualitatively evaluated using the right-of-way data shown on the plan and profile exhibits in Appendix B and the typical cross sections shown in Appendix C. For each of the five vertical options that would create surface-level disruptions, a nominal width was selected from the typical mainline cross sections:

- Aerial Viaduct – 79 feet
- Berm – 85 feet
- At Grade – 96 feet
- Open Trench – 96 feet
- Covered Trench/Tunnel – 96 feet

The Deep Tunnel option was not included because it would not cause property displacements.

In each subsection, the width of the existing Caltrain right-of-way was examined and compared to the nominal width of each vertical option. The result was reported for each vertical option in terms of the percentage of the alignment in a subsection that was narrower than the width of the option. The At Grade option has additional displacement impacts at grade separations where the tracks remain at ground level. These impacts were evaluated using the process illustrated in Figure 4-5. This figure shows a generic grade separation with two configuration options – road over rail and road under rail. As shown in the figure, the road under rail option usually has slightly lower impacts because the vertical clearance requirements for roadways are less than that for railroads. As the last step, each option was given a qualitative rating of low, medium or high displacement impacts based on the analysis described above.

It is expected that right-of-way requirements will be refined through further engineering analysis. For example, if the existing Caltrain corridor lay between a street and a residential neighborhood, the nominal cross section could be shifted into the street as much as possible, while still meeting the design objectives for the rail alignment. The right-of-way required for various vertical configurations varies depending on the placement of each track. Other factors influencing ROW needs include stations and transition segments from one vertical profile to another. See Appendix C for diagrams showing the ROW requirements for various vertical configurations.

Temporary Construction Easements (TCE): It was assumed that an additional 24' would be temporarily required during construction of the Aerial Viaduct, Berm, Open Trench and Covered Trench options. If the ultimate ROW lay between publicly-owned property on one side and privately-owned property on the other, the location of the TCE was adjusted to occupy publicly-owned property where possible.

4.2.3 Utilities

Appendix D includes a table of major utilities along the alignment. Major utilities were defined by their size, operation and/or function. Moving these utilities could be costly or difficult from the perspective of providing continuous utility service.

4.2.4 Environmental Resources and Measures

GIS was used to determine the presence or absence of a particular resource, hazard, or sensitive receptor/land use. GIS also provided the extent, or amount of presence as identified in Tables 4-2 and Table 4-3 such as the acres of waterways, the number of properties, the number of environmentally contaminated sites, etc.

Table 4-1
Environmental Resources Measures

Environmental Resources Measures and Data Sources	
Measure	Data Source
Waterways/Wetlands	
▪ Waterways (acres of waterways affected within ultimate ROW)	USGS, National Hydrography Data, Aerial Interpretation, Caltrain Survey Layer 610
▪ Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	U.S. Fish and Wildlife Service Critical Habitat Portal
Cultural Resources	
• Number of potential structures affected within 1/4 mile of ultimate ROW	National Register of Historic Places, California Register, local registers and inventories
• Number of potential structures affected within ultimate ROW	National Register of Historic Places, California Register, local registers and inventories
• Archeological sensitivity (identified as present or not)	Archaeologist field and aerial photography assessment
Parklands	
• Number of parklands impacted 4(f) and 6(f) within ultimate ROW or 1/4 mile of ultimate ROW	California Protected Areas Database, ESRI StreetMap USA Parks, Bing Map Search, Municipal Web Sites

Table 4-2
Environmental Measures

Environmental Measures and Data Sources	
Measure	Data Source
Noise and Vibration	
• Noise: Number of residential, institutional, medical and park properties within 300' of ultimate ROW	Field visits, local General Plans and Zoning, Google Earth, ESRI, Bing Map Search
• Vibration: Number of residential, institutional, medical and park properties within 200' of ultimate ROW	Field visits, local General Plans and Zoning, Google Earth, ESRI, Bing Map Search
Visual and Scenic Resources	
• Number of residential, institutional, medical and park properties immediately adjacent to the ultimate ROW	Field visits, local General Plans and Zoning, Google Earth, ESRI
• Number of scenic roadways that cross the ROW	Local General Plans
Geologic and Soil Hazards	
• Percent of ultimate ROW susceptible to liquefaction due to presence of liquefiable soils	USGS, in cooperation with the California Geological Survey. Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California – Open-File Report 06-1037.
Hazardous Materials	
• Number of contaminated properties within ultimate ROW or within 1/4 mile	Cortese List, Envirostor, Leaking Underground Fuel Tank program, Spills Leaks Investigations & Cleanup program, National

Environmental Measures and Data Sources	
of ultimate ROW	Priorities List

Though GIS is a valuable tool in determining whether natural resources, hazards, sensitive visual and noise receptors are within or near the ROW, it is not sensitive to variations in the vertical profile of the alignment. For example, the GIS results may indicate that there are 100 residential parcels and 3 schools along a particular segment of the alignment. If the alignment along this segment were at grade, there would be a potential noise exposure impact for these land uses, which would need to be mitigated by the project. However, if the alignment along this segment were in a covered trench or tunnel, the noise impacts to these uses would be different and probably lower (tunnels typically have less noise from passing trains but generate noise from ventilation structures). To account for the effect of different vertical profiles on the measures identified in Tables 4-2 and 4-3, assumptions were developed about the effects of different vertical options. In general, if the GIS results report the presence of a natural resource or hazard within the ROW, an elevated alignment option would likely lessen the impacts compared to an at-grade option, because its footprint within the resource or hazard would be less. A below grade configuration, on the other hand, could avoid the resource or hazard if it were in a tunnel or have similar or worse effects to an at-grade option, if it were in a trench (examples where a trench would be worse than an at-grade option would be locations with subsurface archaeological resources or hazardous materials). An elevated option would typically result in greater noise and visual impacts than an at-grade alignment or a below grade alignment.

The analysis treats as scenic roadways those roadway segments that have been designated as scenic streets, scenic highways, scenic routes, or a similar designation by a local jurisdiction. The identified scenic roadways have been extracted from the general plans of the various cities and counties. Though the criteria for designating a scenic roadway are specific to each locality, the State of California 2003 General Plan Guidelines serves as a reference document for various localities in developing their general plans, which would include designation of scenic roadways. The Guidelines define a scenic highway/route as “A highway, road, drive, or street that, in addition to its transportation function, provides opportunities for the enjoyment of natural and manmade scenic resources and access or direct views to areas or scenes of exceptional beauty or historic or cultural interest. The aesthetics values of scenic routes often are protected and enhanced by regulations governing the development of property or the placement of outdoor advertising.”

4.3 Summary of Evaluation Results

On the following pages, the study corridor is described from north to south by subsection. When a new subsection is introduced, the first set of facing pages provides an overview of the subsection and the evaluation highlights for that subsection. The top of the left hand page includes a brief description of the subsection, followed by an aerial photograph showing the horizontal placement of the study corridor. Below the aerial is a schematic diagram of the vertical design options considered in the evaluation. The subsection boundaries are shown graphically below the schematic diagram.

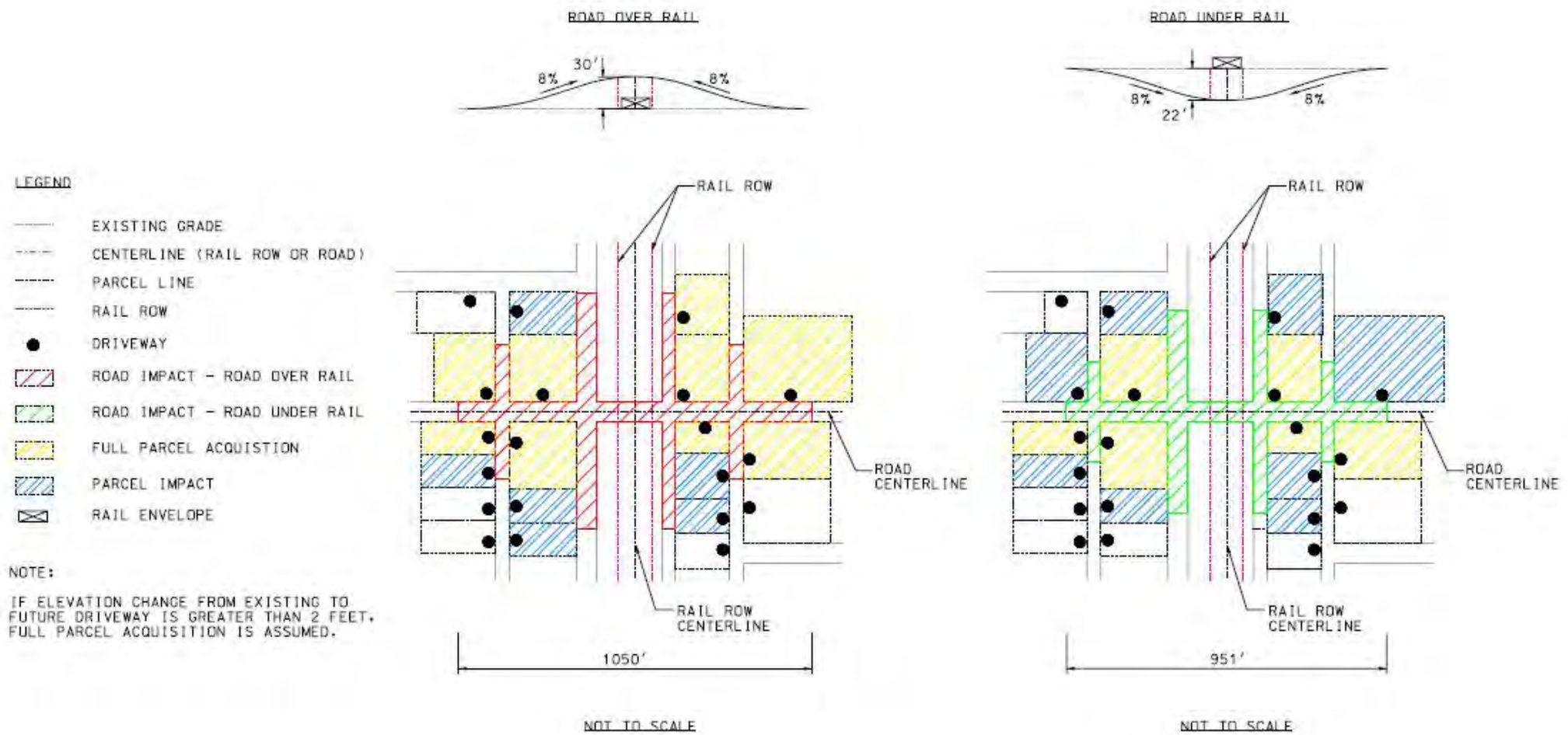
At the top of the right hand page, the sub-subsections are listed with the applicable vertical design options that were carried forward into the detailed evaluation. Following this listing, some pages include notes on the feasibility of specific vertical profiles. These notes are derived from the engineering analysis of the plan and profile, as shown in Appendix B. The location corresponding to each note is shown on the schematic diagram on the left hand page. Following the feasibility notes (if present) is a listing and description of the options carried forward into preliminary engineering design and environmental review as part of the EIR/EIS. This is followed by a listing of the options that will not be carried forward, including the primary reasons for this recommendation.

Station alternatives are discussed in the subsection where they are located. The following stations and location alternatives are being carried forward for further engineering and environmental analysis in these respective subsections:

- Downtown San Francisco – Subsection 0A
- Millbrae (SFO) – Subsection 3D
- Potential Mid-Peninsula Station Locations:
    - Redwood City – Subsection 4C
    - Palo Alto – Subsection 6A
    - Mountain View – Subsection 7B
- San Jose Diridon – Subsection 9B

Following the introductory set of facing pages are a series of tables noting the presence, absence, extent, or amount of each impact, resource, hazard, sensitive receptor, or land use. In these tables, the vertical options identified to be carried forward for further engineering and environmental analysis are indicated with a white background in the table heading. Those options which were not carried forward are indicated with a black background in the table heading. In addition, for those options not carried forward, the primary reason(s) for this recommendation is indicated by shading in the table.

Figure 4-5
Typical Parcel Impacts at Grade Separations



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Subsection #0 (a)

Length: X.X miles Land Use: Urban

Transbay Transit Center to North of Common Street (MP. X.XX to MP. 1.03) - HST at Transbay/4th and King
The Transbay Transit Center and the 4th and King Station Terminal will serve both HST and Caltrain.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

SAN FRANCISCO

SAN JOSE DIRIDON

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

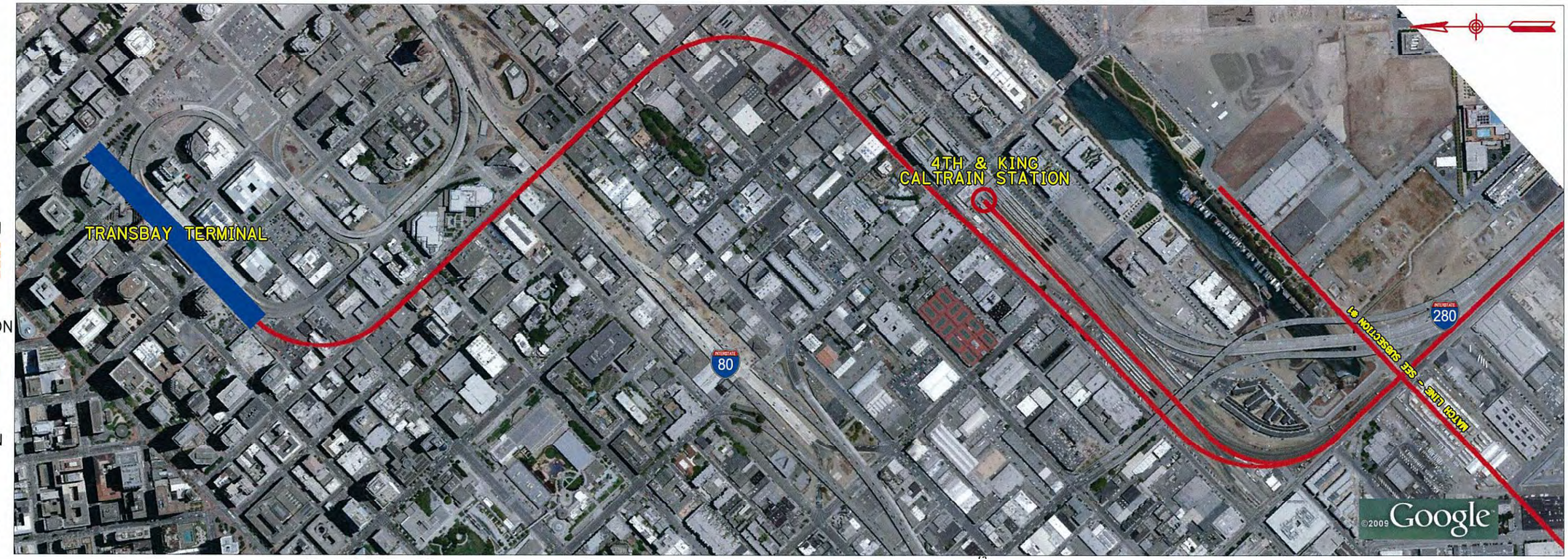
CALTRAIN STATION DESIGN OPTION

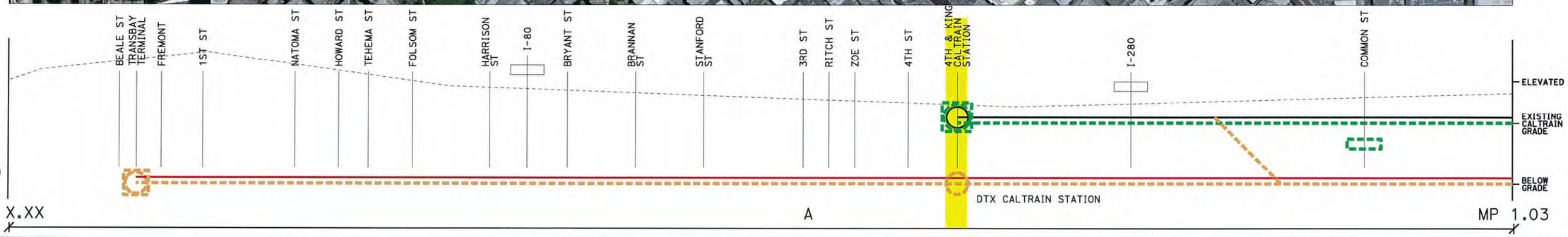
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





CALIFORNIA HIGH SPEED RAIL AUTHORITY

FLY CALIFORNIA
Without ever leaving the ground.

San Francisco - San Jose

DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

Subsection #0 (b)

Length: X.X miles Land Use: Urban

Transbay Transit Center to North of Common Street (MP. X.XX to MP. 1.03) - HST at Transbay Terminal
The Transbay Transit Center Terminal will serve both HST and Caltrain. Caltrain continues to utilize 4th and King Station.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

SAN FRANCISCO

SAN JOSE DIRIDON

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

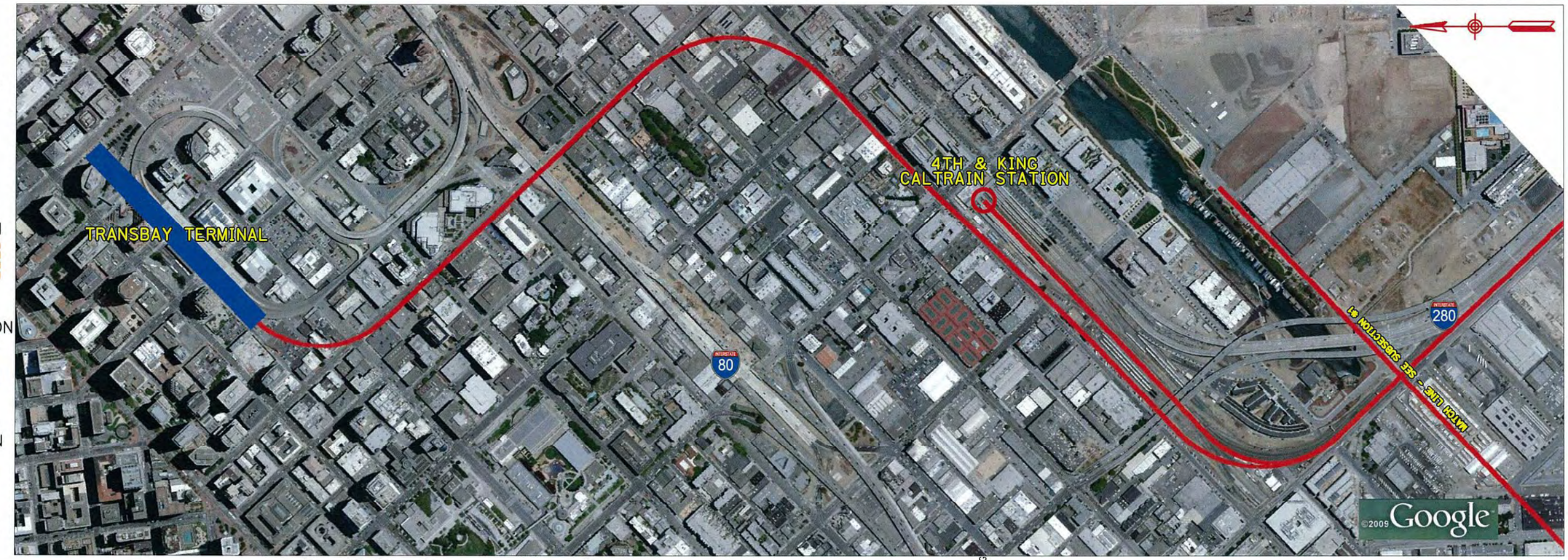
CALTRAIN STATION DESIGN OPTION

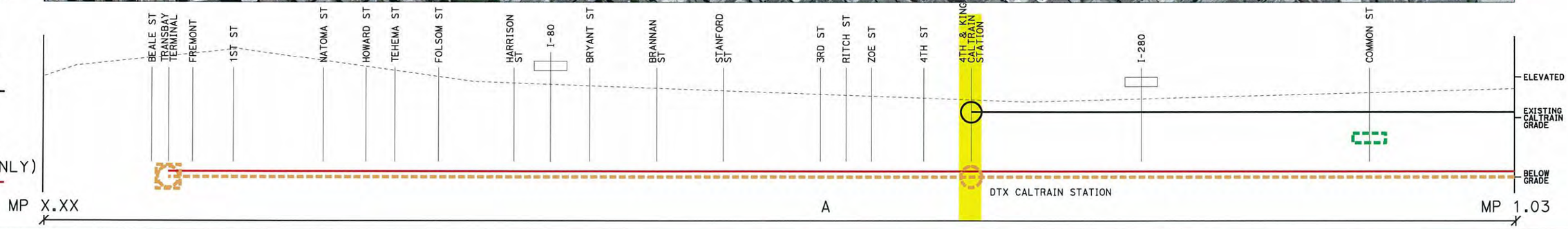
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





CALIFORNIA HIGH SPEED RAIL AUTHORITY

FLY CALIFORNIA
Without ever leaving the ground.

San Francisco - San Jose

DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

Subsection #0 (c)

Length: X.X miles Land Use: Urban

Transbay Transit Center to North of Common Street (MP. X.XX to MP. 1.03) - HST at 4th and King Terminal
The 4th and King Station Terminal will serve both HST and Caltrain.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

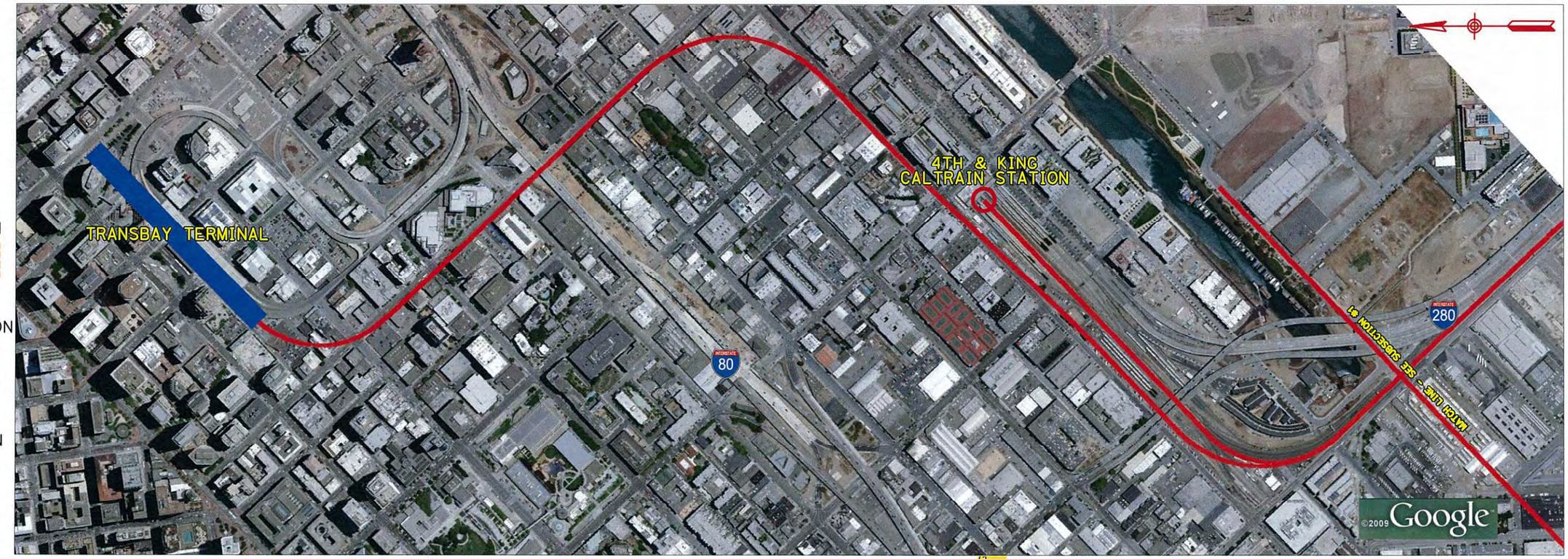
CALTRAIN STATION DESIGN OPTION

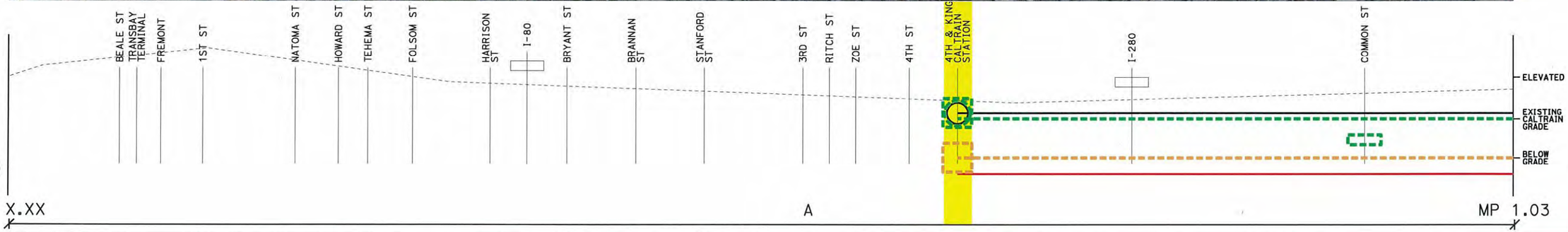
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





CALIFORNIA HIGH SPEED RAIL AUTHORITY

FLY CALIFORNIA
Without ever leaving the ground.

San Francisco - San Jose

DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

Subsection #0 (d)

Length: X.X miles Land Use: Urban

Transbay Transit Center to North of Common Street (MP. X.XX to MP. 1.03) - HST at Transbay (Beale St Option) Terminal
The Beale Street Wing Station Terminal will serve both HST and Caltrain. This would be the one station for HST trains in downtown San Francisco.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

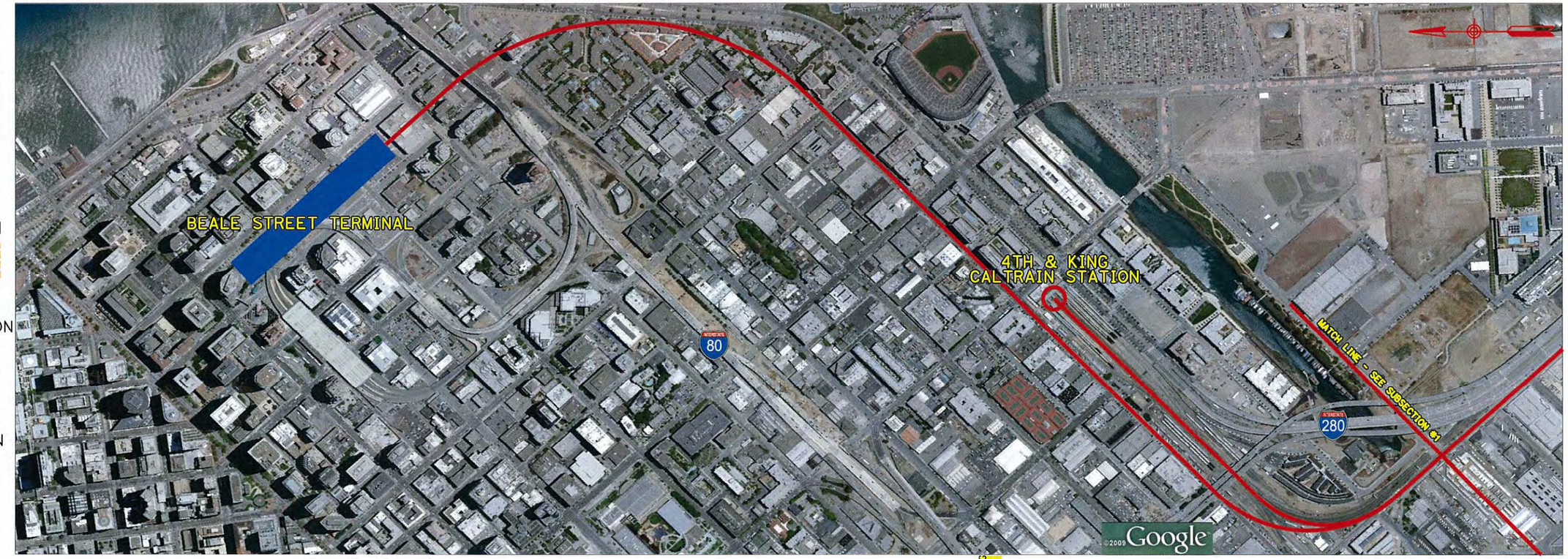
CALTRAIN STATION DESIGN OPTION

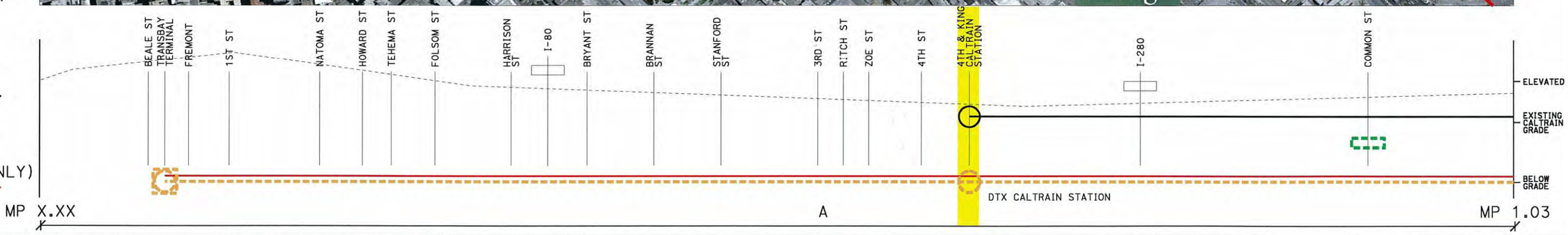
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.1 Subsection 0 – San Francisco

Options Considered

- Option 0(a)A – HST and Caltrain to both Transbay Transit Center (TTC) and 4th & King – This option assumes that tracks will be added in an alignment under Townsend and Second Streets to reach a station in the basement of the new Transbay Transit Center. This option assumes the Transbay Transit Center provides 4 tracks for HST (two center platforms) and 2 tracks for Caltrain (one center platform). The 4th & King station would be reconfigured at-grade to provide longer platforms required by HST. The assumed station layout at 4th & King provides 4 tracks for HST (two center platforms) and 5 tracks for Caltrain (two center platforms and one side platform for special ballpark service), plus an additional center platform for Caltrain along the underground tracks heading to the Transbay Transit Center. See Appendix H for a schematic track diagram of the conceptual improvements at 4th & King Station.
- Option 0(b)A – HST and Caltrain to TTC, Caltrain to 4th & King – This option follows the same alignment as Option 0(a)A. However, in this option, all HST service terminates at the Transbay Transit Center and the 4th & King station is only served by Caltrain. This option assumes the Transbay Transit Center provides 4 tracks for HST (two center platforms) and 2 tracks for Caltrain (one center platform).
- Option 0(c)A – HST to 4th & King, Caltrain to both Transbay and 4th & King – This option is the reverse of Option 0(b)A. All HST service terminates at the 4th & King station; the Transbay Transit Center is only served by Caltrain. HST does not use the track extension under Townsend and Second Streets. The 4th & King station would be reconfigured at-grade to provide longer platforms required by HST. The assumed station layout at 4th & King provides 8 tracks for HST (four center platforms) and 1 track for Caltrain (one side platform for special ballpark service) plus an additional center platform for Caltrain along the underground tracks heading to the Transbay Transit Center. See Appendix H for a conceptual plan of this option.
- Option 0(d)A – HST and Caltrain to both Beale Street and 4th & King – This option assumes that tracks would be added beyond the 4th & King station on an alignment that travels under Townsend Street, The Embarcadero and between Main and Beale Streets. The alignment passes under the Bay Bridge between the anchorage at Beale Street and piers located at Main Street. The alignment would end at an underground terminal oriented 90 degrees from the terminal assumed in Alternatives 0(a)A and 0(b)A. The terminal would be located in a two-block area bordered by Beale Street, Harrison Street, Main Street and Folsom Street.
- Several configurations of the alignment and terminal were investigated to find a configuration that would provide the maximum number of station tracks within the terminal footprint. These configurations are described in Appendix H, which also includes schematic track diagrams, conceptual plans, and conceptual cross sections. The best configuration from the perspective of train operations provides 6 tracks for HST (three center platforms) and 2 tracks for Caltrain (one double-length center platform). The 4th & King station would be reconfigured at-grade to provide the longer platforms required by HST. The assumed station layout at 4th & King is similar to that under Option 0(a)A, and provides 4 tracks for HST (two center platforms) and 5 tracks for Caltrain (two center platforms and one side platform for special ballpark service), plus an additional center platform for Caltrain along the underground tracks heading to the Transbay Transit Center.

Options Carried Forward

Option 0(a)A, in which HST and Caltrain service is offered at the Transbay and 4th & King locations, has been identified to be carried forward into further engineering and environmental analysis. Option 0(a)A is a variant of the TJPA's approved configuration for the Transbay Transit Center with added capacity for HST and Caltrain at the 4th & King station.

Options Not Carried Forward

The following options were not carried forward because they either do not meet project objectives (Options 0(b)A and 0(c)A) or, in the case of Option 0(d)A, provide the same level of service and capacity as Option 0(a)A with significant constructability risks not present with Option 0(a)A.

- Option 0(b)A, with which all HST service goes to the Transbay Transit Center and there is no HST service at the 4th & King station, is not practicable and does not meet project purpose and need and objectives due to insufficient capacity. A conceptual operational analysis of the San Francisco terminal options (see memo in Appendix K) indicated that for most of the day, the terminal capacity is constrained to 4 to 5 trains per hour. This is significantly less than the 10 HST trains per hour objective described in Section 4.1.2.
- Option 0(c)A, which assumes that all HST service terminates at the 4th & King station, does not satisfy Proposition 1A as HST service would not reach the Transbay terminal as a San Francisco terminus. It also lacks sufficient operational capacity, does not connect with regional bus service, and is inconsistent with adopted plans and policies. This inconsistency would result in schedule delays while this option goes through the San Francisco planning and environmental review process. As described in Appendices H and K, Option O(c)A will not support the operation of the conceptual service plan assumed for this analysis. In the operations analysis simulation, the configuration of the yard throat consistently caused multiple delays of between 45 seconds and 8.5 minutes to both inbound and outbound trains.
- Option 0(d)A with which HST service would go to a Beale Street station at Transbay Terminal and also to a 4th & King station is not practicable because of difficulties constructing the tunnel along The Embarcadero and under the Bay Bridge and because it would have extensive impacts to properties and displacements. It is also inconsistent with adopted plans and policies. This option is not practical to construct due to the proximity of the Bay Bridge anchorage and piers to the tunnel alignment. The tracks that approach the terminal would be located deep underground between the Bay Bridge Anchorage and Pier "A" located on the west side of Main Street. The tunnel structure would be within a "zone of influence" of both bridge support structures, requiring shoring to prevent excavation for the tunnel structure from affecting the stability of both bridge structures. Option 0(d)A would also require substantial right of way acquisition including: a residential condominium development with 287 units at 201 Harrison Street; 201 Folsom Street, which has been approved for a residential development with 725 units; a residential condominium development with 31 units at 501 Beale Street, another residential condominium development with 112 units at 88 Townsend Street and a U.S. Postal Service property owned by the federal government. The TJPA has estimated that the right-of-way acquisition cost for Option 0(d)A would be approximately $1.02 billion. This compares to an estimated right-of-way acquisition cost for Option 0(a)A of approximately $280 million.

Table 4-3
Summary Comparison of Design Options for Subsection 0 – San Francisco

Evaluation Measure			0(a)A – HST & Caltrain to both Transbay and 4th & King	0(b)A – HST to Transbay, Caltrain to both Transbay and 4th & King	0(c)A – HST to 4th & King, Caltrain to both Transbay and 4th & King	0(d)A – HST & Caltrain to both Beale Street and 4th & King
			Covered Trench/Tunnel	Covered Trench/Tunnel	At Grade	Covered Trench/Tunnel
Design Objectives	Maximize ridership / revenue potential	Travel time	Essentially the same for Options 0(a)A and 0(d)A	Unable to consistently meet travel time objectives due to congestion resulting from insufficient operational capacity	Does not meet project objectives because the Transbay Terminal would not be a San Francisco terminus; insufficient operational capacity	Essentially the same for Options 0(a)A and 0(d)A
		Route length	Essentially the same for Options 0(a)A, 0(b)A and 0(d)A	Essentially the same for Options 0(a)A, 0(b)A and 0(d)A	Shorter than other options	Essentially the same for Options 0(a)A, 0(b)A and 0(d)A
	Maximize connectivity and accessibility	Intermodal connections	Same for Options 0(a)A and 0(b)A	Same for Options 0(a)A and 0(b)A	Does not connect to BART or regional bus service	Platforms not located directly under regional bus terminal
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different options)	Same for Options 0(a)A, 0(b)A and 0(d)A	Same for Options 0(a)A, 0(b)A and 0(d)A	Lower than other options	Same for Options 0(a)A, 0(b)A and 0(d)A
		Capital cost, does not include ROW	Lower than Option 0(d)A since construction would occur at the Transbay Transit Center, higher than Option 0(b) since 4th & King would be reconfigured for HST	Lower than Option 0(a)A since 4th & King would not be reconfigured for HST	Lowest since Transbay Transit Center would not be configured for HST	Highest since construction would occur on a separate site from the Transbay Transit Center
		Acquisition cost of additional ROW	Lower than Option 0(d)A, higher than Option 0(c)A	Lower than Option 0(a)A, higher than Option 0(c)A	Lowest	Highest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for Options 0(a)A and 0(b)A	Same for Options 0(a)A and 0(b)A	Lower than Option 0(d)A since only 4th & King is served by HST	Lower than Options 0(a)A and 0(b)A since terminal would occupy site of potential TOD planned with Transbay Transit Center
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Inconsistent with adopted plans and policies	Inconsistent with adopted plans and policies
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Essentially the same for Options 0(a)A and 0(b)A, substantial impacts from cut and cover construction in street ROW	Essentially the same for Options 0(a)A and 0(b)A, substantial impacts from cut and cover construction in street ROW	Lower than other options	Substantial impacts from cut and cover construction in street ROW, federal ownership of Post Office property could delay ROW acquisition
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None			
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Same for Options 0(a)A and 0(b)A	Same for Options 0(a)A and 0(b)A	Lower than Options 0(a)A and 0(b)A	Potential disruption to Bay Bridge anchorage and pier
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Medium	Medium	Medium	High. Several residential condominium developments would be affected.
	Properties with access affected	Properties with access affected	None			
	Local traffic effects around station	Increase in traffic congestion	Same for Options 0(a)A and 0(d)A	Less than Options 0(a)A and 0(d)A since only Transbay Transit Center would have HST service	Less than Option 0(b)A since HST ridership would be lower	Same for Options 0(a)A and 0(d)A

Evaluation Measure			0(a)A – HST & Caltrain to both Transbay and 4th & King	0(b)A – HST to Transbay, Caltrain to both Transbay and 4th & King	0(c)A – HST to 4th & King, Caltrain to both Transbay and 4th & King	0(d)A – HST & Caltrain to both Beale Street and 4th & King
			Covered Trench/Tunnel	Covered Trench/Tunnel	At Grade	Covered Trench/Tunnel
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None			
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None			
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None			
	Cultural resources	Number of historic structures within ultimate ROW	4	4	4	4
		Archeological Sensitivity (identified as present or not)	Present; potential disturbance depends on siting of vent structures, tunnel portals, and tunnel depth; lower impacts for At Grade option because of less ground disturbance and shorter alignment.			
	Parklands	Acres of parklands within ultimate ROW	None			
	Agricultural lands	Acres of farmland	Not applicable			
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M), School (S) and park (P) properties within 300' of ultimate ROW	Lower impacts than At Grade option; impacts for this option depend on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than At Grade option; impacts for this option depend on siting of vent structures, tunnel portals, and tunnel depth	R=101-200	Lower impacts than At Grade option; impacts for this option depend on siting of vent structures, tunnel portals, and tunnel depth
		Vibration: Number of residential (R), institutional (I), medical (M), School (S) and park (P) properties within 200' of ultimate ROW	Low impacts expected, but depends on siting of vent structures, tunnel portals, and tunnel depth	Low impacts expected, but depends on siting of vent structures, tunnel portals, and tunnel depth	R=101-200	Low impacts expected, but depends on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R), institutional (I)and park (P) properties immediately adjacent to the ultimate ROW	Visual setting would not be affected by the below-ground alternatives in Subsection 0; the At Grade option would be adjacent to residents who already have direct views of the Caltrain service (R=301-500).			
		Number of scenic roadways that cross the ROW	None			
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	75%	75%	100%	86%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	0/2; impacts depend on siting of vent structures, tunnel portals, and tunnel depth	0/2	0/2	0/2

Subsection #1

Length: 4.8 miles Land Use: Urban

North of Common Street to South Portal Tunnel No. 4 (MP. 1.03 to MP. 5.77)
This subsection is located within the City and County of San Francisco. Except for two crossings near Mission Bay, all other street crossings in this subsection are grade separated. The existing Caltrain alignment passes through a series of hills and valleys necessitating 4 tunnels and several embankment and trench segments. The I-280 freeway structure above the tracks and its supporting columns are constraints in the northern portion of the subsection.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

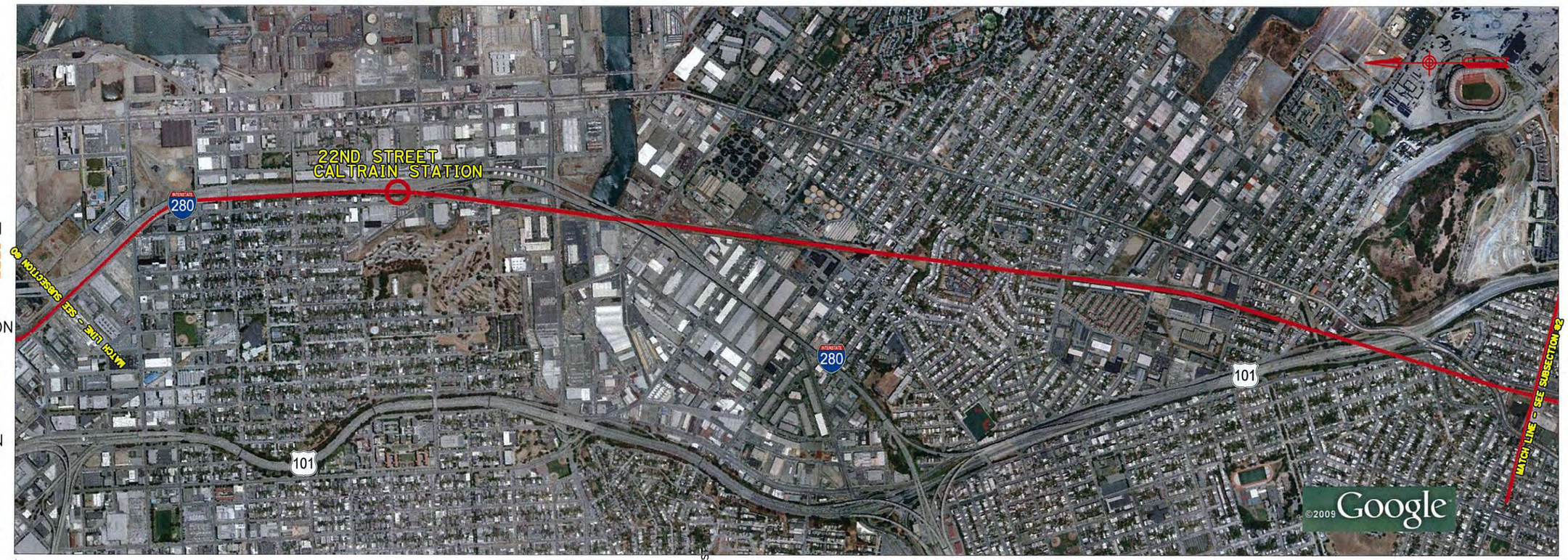
CALTRAIN STATION DESIGN OPTION

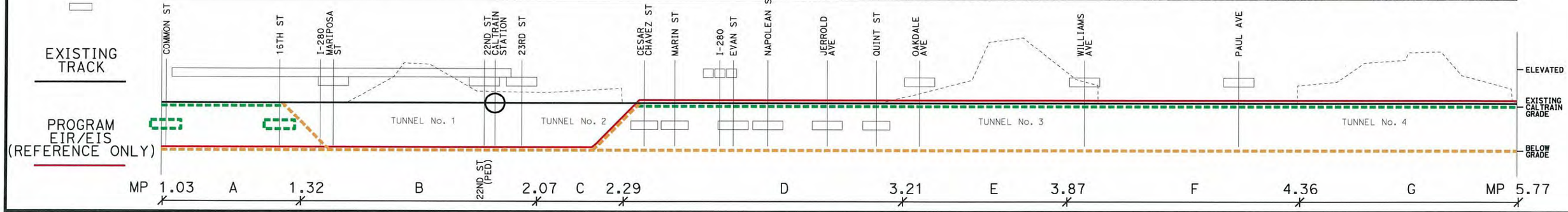
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.2 Subsection 1 – San Francisco

Options Considered

- Subsection 1A – North of Mission Bay Drive to South of 16th Street
  - At Grade
  - Covered Trench/Tunnel
- Subsection 1B – South of 16th Street to South of 23rd Street
  - At Grade
  - Covered Trench/Tunnel
- Subsection 1C – South of 23rd Street to North of Cesar Chavez Street
  - At Grade
  - Covered Trench/Tunnel
- Subsection 1D – North of Cesar Chavez Street to South of Quint Street
  - At Grade
  - Covered Trench/Tunnel
- Subsection 1E – South of Quint Street to North of Williams Street
  - At Grade
  - Covered Trench/Tunnel
- Subsection 1F – North of Williams Street to South of Paul Avenue
  - At Grade
  - Covered Trench/Tunnel
- Subsection 1G – South of Paul Avenue to South of Portal Tunnel No. 4
  - At Grade
  - Covered Trench/Tunnel

Options Carried Forward

The At Grade and Covered Trench/Tunnel options have been identified to be carried forward into further engineering and environmental analysis. Both options include tunnels parallel to existing Caltrain tunnels 1-4. With the At Grade option, the new tunnels would be at approximately the same depth as the existing tunnels, while under the Covered Trench/Tunnel option the new tunnels would be deeper than the existing tunnels. Under either option, Caltrain and freight would continue to use the existing Caltrain tracks. The Covered Trench/Tunnel option would begin as a shallow tunnel under 7th Street and continue as a deeper tunnel under Pennsylvania Avenue. Substantial right-of-way acquisition would be required along 7th Street if the At Grade option was selected in this segment. The existing railroad leads to the Port of San Francisco and Hunters Point would continue to be served by the existing Caltrain tracks under both options.

Options Not Carried Forward

None.

Table 4-4
Summary Comparison of Design Options for Subsection 1 – San Francisco

Evaluation Measure			1A - North of Mission Bay Drive to South of 16th Street		1B & 1C - South of 16th Street to North of Cesar Chavez Street		1D, 1E, 1F & 1G - North of Cesar Chavez Street to South Portal Tunnel No. 4	
			At Grade	Covered Trench/ Tunnel	At Grade	Covered Trench / Tunnel	At Grade	Covered Trench/ Tunnel
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options		Same for all options		Same for all options	
		Route length	Same for all options		Same for all options		Same for all options	
	Maximize connectivity and accessibility	Intermodal connections	Not applicable		Not applicable		Not applicable	
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Lowest	Higher than At Grade option, due to tunnel walls, drainage, ventilation, life safety, etc	High	High	High	High
		Capital cost ($ 2009), does not include ROW	114 million	114 million	299 million	299 million	458-1,049 million	978 million
		Acquisition cost of additional ROW	Highest	Lowest	Lowest	Lowest	Highest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable		Not applicable		Not applicable	
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies		Consistent with adopted plans and policies	Inconsistent with adopted plans and policies	Consistent with adopted plans and policies	
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Construction would primarily occur within ultimate ROW	Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Construction would primarily occur within ultimate ROW	Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Construction would primarily occur within ultimate ROW	Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None		None			
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None		None		None	
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Approximately 10% of subsection has existing ROW <60', 10% is between 80'-89' and 80% is over 100'. Impacts due to grade separations at Mission Bay Drive and 16th Street	Low; Approximately 10% of subsection has existing ROW <60', 10% is between 80'-89' and 80% is over 100'. Possibly some impacts due to ventilation structures	Low; Possibly some impacts due to ventilation structures	Low; Possibly some impacts due to ventilation structures	Low; Approximately 30% of subsection has existing ROW is between 80'-89' and 70% is over 100'; Possibly some impacts due to ventilation structures	Low; Nominal width for this option is 96'. Approximately 30% of subsection has existing ROW is between 80'-89' and 70% is over 100'; Possibly some impacts due to ventilation structures
	Properties with access affected	Properties with access affected	Access for properties affected due to grade separations	None	None		None	
	Local traffic effects around station	Increase in traffic congestion	Not applicable		Not applicable		Not applicable	

Evaluation Measure			1A - North of Mission Bay Drive to South of 16th Street		1B & 1C - South of 16th Street to North of Cesar Chavez Street		1D, 1E, 1F & 1G - North of Cesar Chavez Street to South Portal Tunnel No. 4	
			At Grade	Covered Trench/ Tunnel	At Grade	Covered Trench / Tunnel	At Grade	Covered Trench/ Tunnel
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Improved traffic conditions with grade separations at Mission Bay Drive and 16th Street		None		None	
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None		0.05	0.34, may be avoided depending on siting of vent shafts, tunnel portals, and tunnel depth	0.15	Lower impact than At-Grade option, depending on siting of vent shafts, tunnel portals, and tunnel depth
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None		None	2	2	
	Cultural resources	Number of historic structures within ultimate ROW	None		2	None	None	
		Archeological Sensitivity (identified as present or not)	Present		Present		Present	
	Parklands	Acres of parklands within ultimate ROW	None		None		0.68	Lower impacts than At Grade option
	Agricultural lands	Acres of farmland	Not applicable		Not applicable		Not applicable	
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	None		R=301-500, I<5, M<5, S<5	R=301-500, I<5, M<5, S<5; impacts depend on siting of vent structures and tunnel portals	R=>1000, I=21-40, S<5, P<5	Lower impacts than At-Grade option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	None		R=201-300, I<5, S<5; M<5	R=201-300, I<5, S<5; M<5; impacts depend on siting of vent structures, tunnel portals, and tunnel depth	R=701-1000, I=21-40, P=5-10	Lower impacts than At-Grade option, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	None		R=60-100	R=60-100	R=60-100	Minimal impacts
		Number of scenic roadways that cross the ROW	1	Minimal impacts	Minimal impacts		1	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	Minimal impacts		81%	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	Lower impacts than Covered Trench/Tunnel option	0/1	0/1	0/1	Lower impacts than Covered Trench/Tunnel option	0/6

Subsection #2

Length: 8.6 miles Land Use: Urban

South Portal Tunnel No. 4 to South of Millbrae Avenue (MP. 5.77 to MP. 14.38)
This subsection is located in the Cities of Brisbane, South San Francisco, San Bruno and Millbrae. The existing Caltrain alignment is at-grade in this subsection and many crossings are grade separated. The northern portion of this subsection is completely grade separated and includes an existing 4-track segment in Brisbane. In the southern portion of the subsection, BART runs underneath and alongside the Caltrain tracks.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

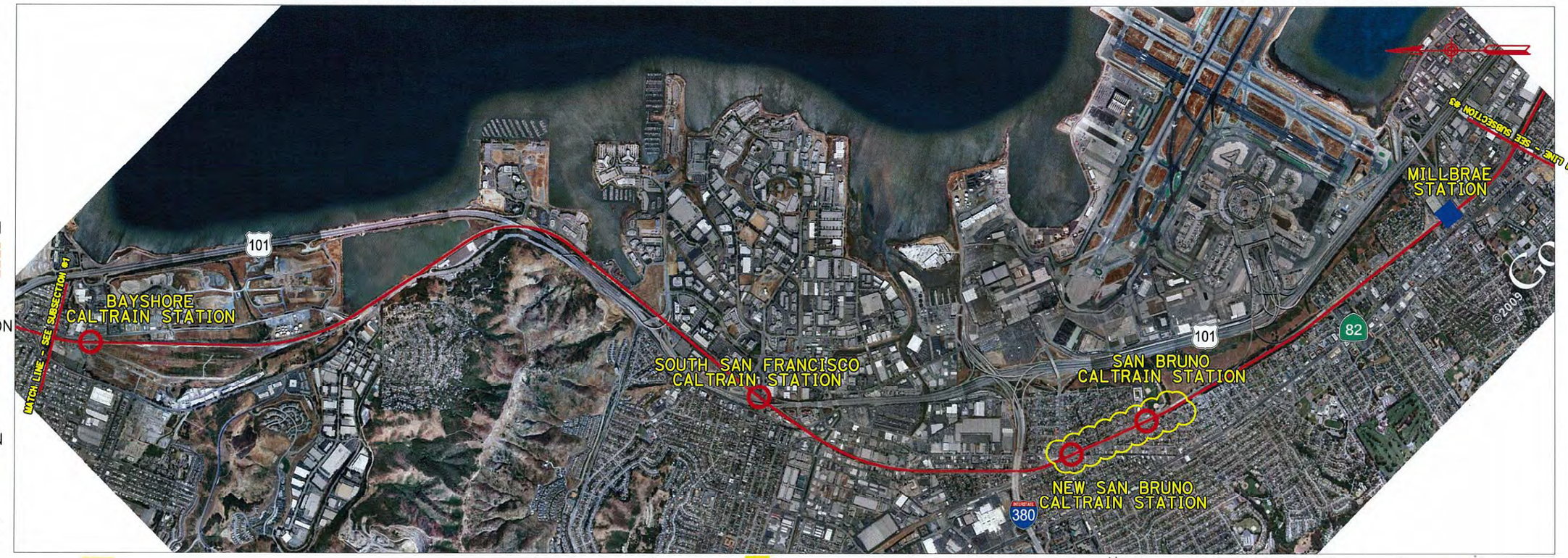
CALTRAIN STATION DESIGN OPTION

ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)



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4.3.3 Subsection 2 – Brisbane, South San Francisco, San Bruno and Millbrae

Options Considered

- Subsection 2A – South Portal Tunnel No. 4 to South of Colma Creek
  - At Grade
- Subsection 2B – South of Colma Creek to South of I-380
  - Aerial Viaduct
  - Berm
  - At Grade
- Subsection 2C – South of I-380 to South of Center Street
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench (HST Only)
  - Covered Trench/Tunnel (HST Only)
- Subsection 2D – South of Center Street to South of Millbrae Avenue
  - At Grade
  - Open Trench (HST Only)
  - Covered Trench/Tunnel (HST Only)

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 2A: At Grade. The existing tracks are at grade and all roadway crossings are grade separated. This subsection also includes an existing four-track segment.
- 2B: Berm. The tracks would be partially elevated and roadway crossings would be partially depressed.
- 2C: Aerial Viaduct, Berm, Open Trench (HST Only), Covered Trench/Tunnel (HST Only). Berm would be the option in the segment north of San Felipe Avenue where the San Bruno Grade Separation Project is located; the Alternatives Analysis assumes that this project will be constructed. At Grade would be the option between San Felipe Avenue and Santa Lucia Avenue. Aerial Viaduct, Berm, Open Trench (HST Only), Covered Trench/Tunnel (HST Only) would be options south of Santa Lucia Avenue, where the alignment begins to transition to a new grade separation at Center Street.
- 2D: At Grade, Open Trench (HST Only) or Covered Trench/Tunnel (HST Only). This would be a configuration that leaves the existing Caltrain tracks in the At Grade option and stacks the new tracks and the Millbrae (SFO) HST station below the existing tracks in either the Open Trench or Covered Trench/Tunnel option. This configuration would avoid right-of-way impacts at the Millbrae intermodal station where there are local plans for a transit-oriented development. The new tracks would need to be below the existing storm drains crossing the Caltrain corridor south of Hillcrest Boulevard.

Options Not Carried Forward

The following options were not carried forward for the reasons listed below:

- 2A: None.
- 2B: Aerial Viaduct, At Grade. A fully elevated Aerial Viaduct option is not practical due to the impacts on freight rail connections to South San Francisco Yard and the Granite Rock/Central Concrete tracks. An At Grade option would have substantial property impacts due to right-of-way needed for grade separations at Linden Avenue and Scott Street.
- 2C: None.
- 2D: At Grade. This configuration would have right-of-way impacts at the Millbrae intermodal station where there are local plans for a transit-oriented development.

Table 4-5
Summary Comparison of Design Options for Subsection 2 – Brisbane, South San Francisco, San Bruno, Millbrae

Evaluation Measure			2A - South Portal Tunnel No. 4 to South of Colma Creek	2B - South of Colma Creek to South of I-380			2C - South of I-380 to South of Center Street				
			At Grade	Aerial Viaduct	Berm	At Grade	Aerial Viaduct	Berm	At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options	Same for all options	Same for all options				
		Route length	Same for all options	Same for all options	Same for all options	Same for all options	Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Aerial Viaduct option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	74 million	-	66 million	-	281-475 million	279-441 million	212-408 million	212-443 million	374-475 million
		Acquisition cost of additional ROW	Highest	Medium	Medium	Highest	Medium	Medium	Highest	Medium	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable			Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies			Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Construction would primarily occur within ultimate ROW	Medium; Nominal width with TCE for this option is 103'. Approximately 15% of subsection is <90' and 85% over 100'	Medium; Nominal width with TCE for this option is 109'. Approximately 15% of subsection is <90' and 85% over 100'	Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 103'. Approximately 70% of subsection is <90' and 30% over 100'. Public ROW available for TCE	Low; Nominal width with TCE for this option is 109'. Approximately 70% of subsection is <90' and 30% over 100'. Public ROW available for TCE	Construction would primarily occur within ultimate ROW	Approximately 70% of subsection is <90' and 30% over 100'. Public ROW available for TCE	Approximately 70% of subsection is <90' and 30% over 100'. Public ROW available for TCE
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Sierra Point Lumber Spur and South San Francisco Yard	Not feasible to maintain connections to South San Francisco Yard and Granite Rock/Central	South San Francisco Yard and Granite Rock/Central Concrete Trackage	South San Francisco Yard and Granite Rock/Central Concrete Trackage	None				

Evaluation Measure			2A - South Portal Tunnel No. 4 to South of Colma Creek	2B - South of Colma Creek to South of I-380			2C - South of I-380 to South of Center Street				
			At Grade	Aerial Viaduct	Berm	At Grade	Aerial Viaduct	Berm	At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
				Concrete Trackage							
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None			None				
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW is <90'' and 90% is over 100'	Low; Nominal width for this option is 79'. Existing ROW is over 80' throughout the subsection	Low; Nominal width for this option is 85'. Approximately 15% of subsection has existing ROW between 80'-89' and 85% is over 100'	Medium; Nominal width for this option is 96'. Approximately 15% of subsection has existing ROW <90' and 85% is over 100', impacts due to grade separations at Linden Avenue and Scott Street	Low; Nominal width for this option is 79'. Approximately 10% of subsection has existing ROW <70', 25% is between 70'-79', 65% is over 80'	Low; Nominal width for this option is 85'. Approximately 35% of subsection has existing ROW <80', 35% is between 80'-89' and 30% is over 100'	Medium; Nominal width for this option is 96'. Approximately 70% of subsection has existing ROW <90' and 30% is over 100', impacts due to grade separation at Center Street	Approximately 35% of subsection has existing ROW <80', 35% is between 80'-89' and 30% is over 100'	Approximately 35% of subsection has existing ROW <80', 35% is between 80'-89' and 30% is over 100'
	Properties with access affected	Properties with access affected	None	None	None	Access for properties affected due to grade separations at Linden Avenue and Scott Street	None	None	Access for properties affected due to grade separation at Center Street	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable			Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None	Improved traffic conditions with grade separations at Linden Avenue and Scott Street	Improved traffic conditions with grade separations at Linden Avenue and Scott Street	Improved traffic conditions with grade separations at Linden Avenue and Scott Street	Improved traffic conditions with grade separation at Center Street				
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	3.89 acres	Similar or lower impact than At Grade option	Similar or lower impact than At Grade option	0.05	Similar or lower impact than At Grade option	Similar or lower impact than At Grade option	0.38	0.38; greater impacts than At Grade option	
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None			None				
	Cultural resources	Number of historic structures within	3	2	2	2	None				

Evaluation Measure			2A - South Portal Tunnel No. 4 to South of Colma Creek	2B - South of Colma Creek to South of I-380			2C - South of I-380 to South of Center Street				
			At Grade	Aerial Viaduct	Berm	At Grade	Aerial Viaduct	Berm	At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
		ultimate ROW									
		Archeological Sensitivity (identified as present or not)	Present	Present			Present		Present; lower impacts than Aerial Viaduct and Berm options	Present	
	Parklands	Acres of parklands within ultimate ROW	None	None			None				
	Agricultural lands	Acres of farmland	Not applicable	Not applicable			Not applicable				
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R-41-60, I<5, M<5, P=11-20	R=101-200, P=5-10	R=101-200, P=5-10	Lower impacts than Aerial Viaduct and Berm options	R=501-700, I=5-10, M<5, S=5-10, P=5-10	R=501-700, I=5-10, M<5, S=5-10, P=5-10	Lower impacts than Aerial Viaduct and Berm options		
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=11-20, I<5, M<5, P=20-40	Lower impacts than At Grade option		R=61-100, P<5	Lower impacts than At Grade option		R=301-500, I=5-10, M<5, S=5-10, P=5-10	Lower impacts than Aerial Viaduct and Berm options	
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=5-10	R=21-40, P<5	R=21-40, P<5	Lower impacts than Aerial Viaduct and Berm options	R=201-300, P<5	R=201-300, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	
		Number of scenic roadways that cross the ROW	None	Minimal impacts		2	Minimal impacts		2	Minimal impacts	
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	60%	32%	32%	32%	9%	9%	9%	9%	9%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	2/18	2/5	2/5	2/5	0/8	0/8	0/8	0/8; greater impacts than At Grade option	

Subsection 2 continued

Evaluation Measure			2D - South of Center Street to South of Millbrae Avenue		
			At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options		
		Route length	Same for all options		
	Maximize connectivity and accessibility	Intermodal connections	Same for all options		
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	87-356 million	95-195 million	330-356 million
		Acquisition cost of additional ROW	Highest	Medium	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for all options (Millbrae HST Station in this subsection)		
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Inconsistent with adopted plans and policies		Consistent with adopted plans and policies
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 80% of subsection has existing ROW over 100'	Low; Nominal width with TCE for this option is 120'. Approximately 80% of subsection has existing ROW over 100'
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None		
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	11' wide and 60' wide storm drains south of Hillcrest Boulevard	
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Approximately 20% of subsection has existing ROW <90' and 80% is over 100'	Low; Approximately 20% of subsection has existing ROW <90' and 80% is over 100'	Low; Approximately 20% of subsection has existing ROW <90' and 80% is over 100', Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None		
	Local traffic effects around station	Increase in traffic congestion	Same for all options		
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None		

Evaluation Measure			2D - South of Center Street to South of Millbrae Avenue		
			At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impact than Trench options	0.48	0.48
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None		
	Cultural resources	Number of historic structures within ultimate ROW	1	1	1
		Archeological Sensitivity (identified as present or not)	Present; Lower impacts than Trench options	Present	
	Parklands	Acres of parklands within ultimate ROW	None		
	Agricultural lands	Acres of farmland	Not applicable		
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=61-100, I<5, M=5-10P<5	Lower impacts than At Grade option	Lower impacts than Open Trench option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=41-60, I<5,, MP<5	Lower impacts than At Grade option	
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=20-40	Minimal impacts	
		Number of scenic roadways that cross the ROW	1	Lower impacts than At Grade option	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	Lower impacts than Trench options	0/5	0/5

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Subsection #3

Length: 4.9 miles Land Use: Urban

South of Millbrae Avenue to North of Highway 92 (MP. 14.38 to MP. 19.29)
This subsection is located in the Cities of Burlingame and San Mateo. In this subsection, the Caltrain tracks are primarily at-grade as are most of the crossings; those that are grade-separated have sub-standard clearances. This subsection includes a tight area through downtown San Mateo where a number of closely spaced at-grade crossings are an integral part of the street grid.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

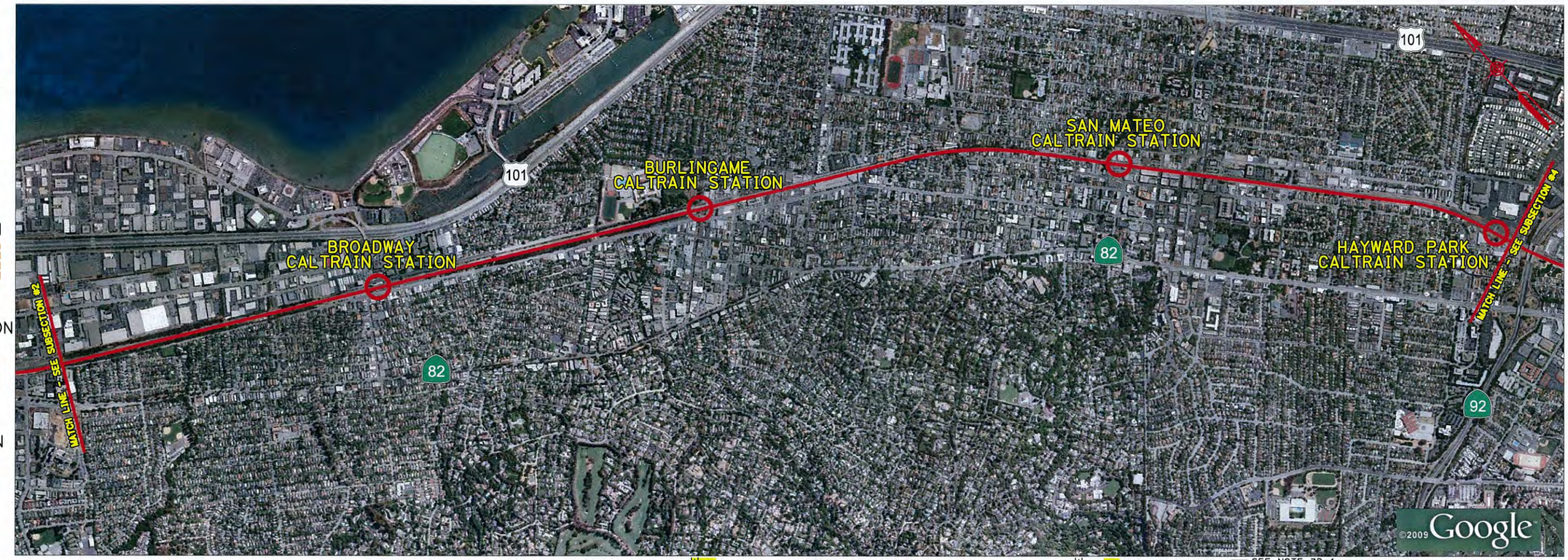
CALTRAIN STATION DESIGN OPTION

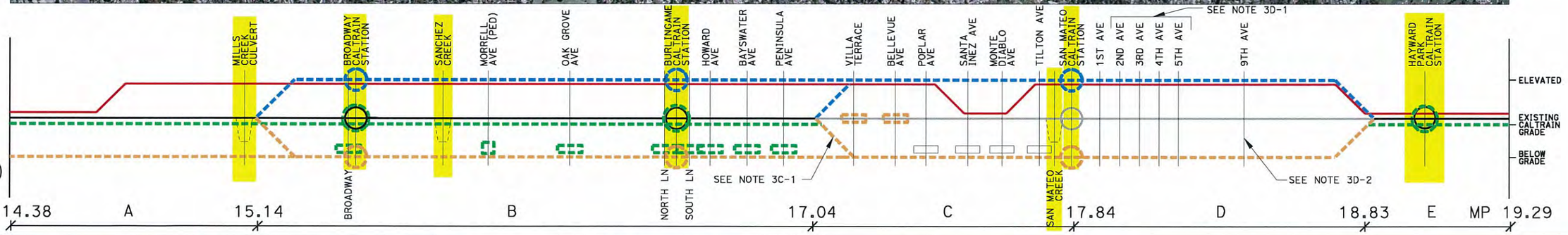
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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DRAFT Preliminary Alternatives Discussion
February 1, 2010

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4.3.4 Subsection 3 – Burlingame and San Mateo

Options Considered

- Subsection 3A – South of Millbrae Avenue to South of Mills Creek
  - Aerial Viaduct
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
- Subsection 3B – South of Mills Creek to North of Villa Terrace
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
- Subsection 3C – North of Villa Terrace to North of San Mateo Caltrain Station
  - Aerial Viaduct
  - Berm
  - Open Trench
  - Covered Trench/Tunnel
- Subsection 3D – North of San Mateo Caltrain Station to North of Hayward Park Station
  - Aerial Viaduct
  - Berm
  - Open Trench
  - Covered Trench/Tunnel
- Subsection 3E – North of Hayward Park Station to North of Highway 92
  - At Grade

Vertical Profile Feasibility Notes

Note	Issue	Description
3C-1	Adjusted	Unable to begin elevated and below grade options after Peninsula Avenue due to clearance constraints at Bellevue Avenue. Peninsula Avenue and Villa Terrace would need to be adjusted vertically.
3D-1	Adjusted	2nd Avenue, 3rd Avenue, 4th Avenue and 5th Avenue would need to be partially lowered for elevated option due to constraint of returning to grade prior to horizontal curves.
3D-2	Adjusted	9th Avenue would need to be adjusted vertically for elevated and below grade options due to constraints of returning to grade prior to horizontal curves.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 3A: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel.
- 3B-3D: Aerial Viaduct, Open Trench, Covered Trench/Tunnel. The Open Trench and Covered Trench/Tunnel options would need to be below the existing storm drains crossing the Caltrain corridor near Oak Grove Avenue and Villa Terrace.
- 3E: At Grade.

Options Not Carried Forward

The following options were not carried forward for the reasons listed below:

- 3A: None.
- 3B-3D: At Grade, Berm. The At Grade option would require substantial right-of-way acquisition due to existing at grade roadway crossings. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option.
- 3E: None.

Table 4-6
Summary Comparison of Design Options for Subsection 3 – Burlingame, San Mateo

Evaluation Measure			3A - South of Millbrae Avenue to South of Mills Creek			
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options			
		Route length	Same for all options			
	Maximize connectivity and accessibility	Intermodal connections	Not applicable			
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than At Grade option due to aerial structure	Lowest	Higher than Aerial Viaduct and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	-	9 million	132 million	345 million
		Acquisition cost of additional ROW	-	Highest	Medium	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable			
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies			
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 102'. Existing ROW is over 100' throughout the subsection	Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Existing ROW is over 100' throughout the subsection	Low; Nominal width with TCE for this option is 120'. Existing ROW is over 100' throughout the subsection
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None			
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None	2-83"x53" Oval CIP storm drain	
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Existing ROW is over 100' throughout the subsection	Low; Nominal width for this option is 96'. Existing ROW is over 100' throughout the subsection	Low; Nominal width for this option is 96'. Existing ROW over 100' throughout the subsection	Low; Nominal width for this option is 96'. Existing ROW over 100' throughout the subsection, Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None			
	Local traffic effects around station	Increase in traffic congestion	Not applicable			
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None			

Evaluation Measure			3A - South of Millbrae Avenue to South of Mills Creek			
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impact than Trench options		0.46	0.46
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None			
	Cultural resources	Number of historic structures within ultimate ROW	None			
		Archeological Sensitivity (identified as present or not)	None			
	Parklands	Acres of parklands within ultimate ROW	None			
	Agricultural lands	Acres of farmland	Not applicable			
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=41-60	Lower impacts than Aerial Viaduct option	Lower impacts than At Grade option	Lower impacts than Open Trench option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=21-40; lower impacts than At Grade option	R=21-40	Lower impacts than At Grade option	
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=11-20	R=11-20; lower impacts than Aerial Viaduct option	Minimal impacts	
		Number of scenic roadways that cross the ROW	None			
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	66%	66%	Minimal impacts	
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	None			

Subsection 3 continued

Evaluation Measure			3B - South of Mills Creek to North of Villa Terrace				
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options				
		Route length	Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	194 million	-	-	433 million	937 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Medium	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies	Consistent with adopted plans and policies	
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 70% of subsection has existing ROW over 100'	Low; Nominal width with TCE for this option is 109'. Approximately 70% of subsection has existing ROW over 100'	Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 70% of subsection has existing ROW over 100'	Low; Nominal width with TCE for this option is 120'. Approximately 70% of subsection has existing ROW over 100'
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None				
	Disruption / relocation of utilities	Identify major utilities requiring relocation	60kV electric junction line near 9th Avenue	60kV electric junction line near 9th Avenue	None	2-90" RCP near Oak Grove Avenue	
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Approximately 20% of subsection has existing ROW between 70'-79' and 80% is over 80'	Low; Nominal width for this option is 85'. Approximately 20% of subsection has existing ROW <80', and 80% is over 90'	High; Nominal width for this option is 96'. Approximately 20% of subsection has existing ROW <90', 10% is between 90'-99' and 70% is over 100', impacts due to grade separations at Broadway, Oak Grove Avenue, North Lane, South Lane, Howard Avenue, Bayswater Avenue and Peninsula Avenue	Low; Nominal width for this option is 96'. Approximately 20% of subsection has existing ROW <90', 10% is between 90'-99' and 70% is over 100'	Low; Nominal width for this option is 96'. Approximately 20% of subsection has existing ROW <90'', 10% is between 90'-99' and 70% is over 100', Possibly some due to ventilation structures

Evaluation Measure			3B - South of Mills Creek to North of Villa Terrace				
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to grade separations at Broadway, Oak Grove Avenue, North Lane, South Lane, Howard Avenue, Bayswater Avenue and Peninsula Avenue	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Improved traffic conditions with grade separations at Broadway, Oak Grove Avenue, North Lane, South Lane, Howard Avenue, Bayswater Avenue and Peninsula Avenue	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm option	Lower impacts than Trench options	Lower impacts than Trench options	1.0 acres	1.0 acres
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None				
	Cultural resources	Number of historic structures within ultimate ROW	1	1	1	1	1
		Archeological Sensitivity (identified as present or not)	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present	Present
	Parklands	Acres of parklands within ultimate ROW	None				
	Agricultural lands	Acres of farmland	Not applicable				
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=301-500, I<5, M<5, P<5	R=301-500, I=5-10, M<5, S<5, P=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, I<5, S<5, P=5-10	Lower impacts than Berm option	Lower impacts than Berm option
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200	R=101-200, P<5; Strong community perception of significant “barrier effect” from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	1	1	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	15%	15%	15%	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options, depending on siting of support columns	Lower impacts than Trench options	Lower impacts than Trench options	0/8	0/8

Subsection 3 continued

Evaluation Measure			3C & 3D - North of Villa Terrace to North of Hayward Park Station				3E - North of Hayward Park Station to North of Highway 92
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	At Grade
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options				Same for all options
		Route length	Same for all options				Same for all options
	Maximize connectivity and accessibility	Intermodal connections	Not applicable				Not applicable
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm option, due to aerial structure	Lowest	Higher than Berm option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Low
		Capital cost ($ 2009), does not include ROW	265 million	-	425 million	894 million	30 million
		Acquisition cost of additional ROW	Medium	Medium	Medium	Lowest	Highest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable				Not applicable
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Inconsistent with adopted plans and policies		Consistent with adopted plans and policies
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	High; Nominal width with TCE for this option is 103'. Approximately 70% of existing ROW less than 100'	High; Nominal width with TCE for this option is 109'. Approximately 70% of existing ROW less than 100'	High; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	High; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	Low; Construction would primarily occur within ultimate ROW
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None				None
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None		10' wide storm drain near Villa Terrace		None
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Medium; Nominal width for this option is 79'. Approximately 15% of subsection has existing ROW <70', 20% is between 70'-79' and 65% is over 80'	Medium; Nominal width for this option is 85'. Approximately 35% of subsection has existing ROW <80', 15% is between 80'-89' and 50% is over 90'	Medium; Nominal width for this option is 96'. Approximately 50% of subsection has existing ROW <90', 15% between 90'-99' and 35% over 100'	Medium; Nominal width for this option is 96'. Approximately 50% of subsection has existing ROW <90', 15% is between 90'-99' and 35% is over 100', Possible impacts due to ventilation structures	Low; Nominal width for this option is 96'. Existing ROW is over 100' throughout this subsection
	Properties with access affected	Properties with access affected	Access for properties affected due to ultimate ROW requirements	Access for properties affected due to ultimate ROW requirements	Access for properties affected due to ultimate ROW requirements		None

Evaluation Measure			3C & 3D - North of Villa Terrace to North of Hayward Park Station				3E - North of Hayward Park Station to North of Highway 92
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	At Grade
	Local traffic effects around station	Increase in traffic congestion	Not applicable				Not applicable
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 traffic lane along Railroad Avenue; Improved traffic conditions at grade separations in this subsection	Loss of 1 traffic lane along Railroad Avenue; Improved traffic conditions at grade separations in this subsection; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Loss of 1 traffic lane along Railroad Avenue; Improved traffic conditions at grade separations in this subsection		None
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm options	Lower impacts than Trench options	0.06 acres	0.06 acres	0.14 acres
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None				None
	Cultural resources	Number of historic structures within ultimate ROW	4	4	4	4	None
		Archeological Sensitivity (identified as present or not)	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present	Present	Present
	Parklands	Acres of parklands within ultimate ROW	None				None
	Agricultural lands	Acres of farmland	Not applicable				Not applicable
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=701-1000, I<5, M<5; S<5	R=701-1000, I<5, M<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Open Trench option	R=101-200, I<5
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=501-700; I<5; M<5	R=501-700	Lower impacts than Berm and Aerial Viaduct options	Lower impacts than Berm and Aerial Viaduct options	R=61-100, P<5
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=200-500	R=501-700; Strong community perception of significant “barrier effect” from berm structure though this area	Minimal impacts		R=20-40
		Number of scenic roadways that cross the ROW	2	2	Minimal impacts		3
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	3%	3%	Minimal impacts		1%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	Lower impacts than Trench options, depending on siting of support columns	Lower impacts than Trench options	3/12	3/12	0/8

Subsection #4

Length: 7.6 miles Land Use: Urban

North of Highway 92 to North of 5th Avenue (MP. 19.29 to MP. 26.88)
This subsection is located in the Cities of San Mateo, Belmont, San Carlos and Redwood City. For most of the northern portion of this subsection, the existing Caltrain tracks are on a recently constructed embankment that passes over the cross streets. In the southern portion of this subsection the at-grade Caltrain tracks pass through a number of at-grade crossings in downtown Redwood City. There is an existing 4 track segment at the southern end of this subsection.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

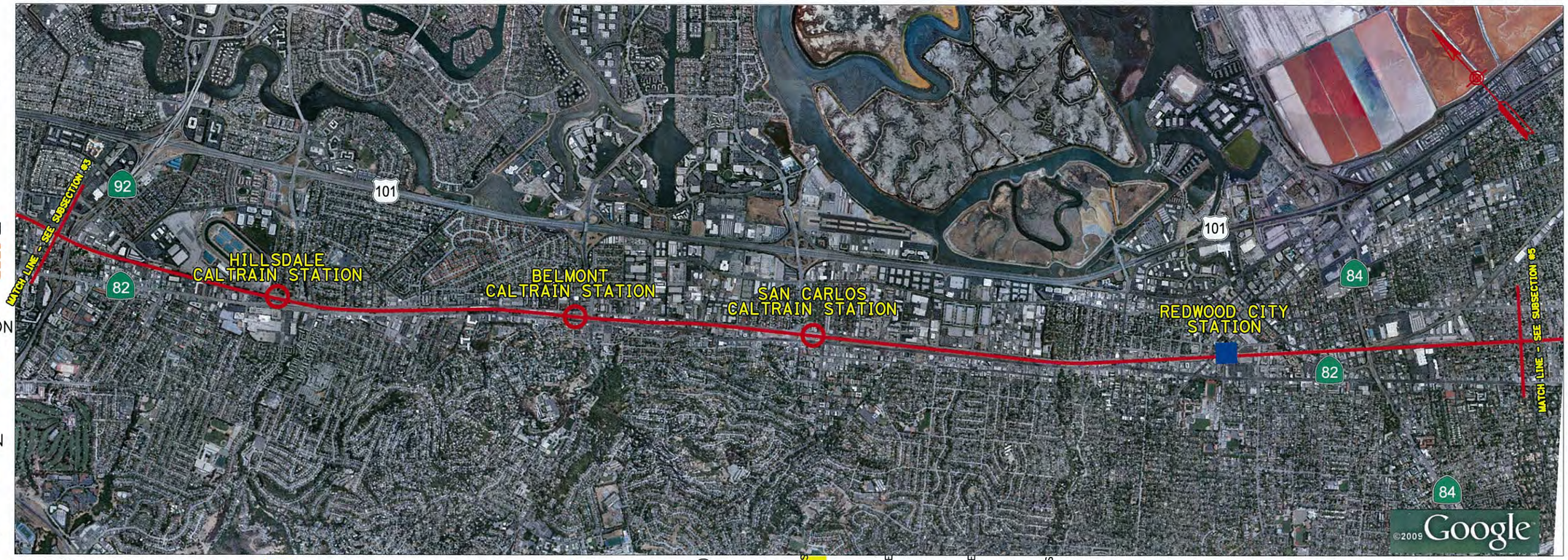
CALTRAIN STATION DESIGN OPTION

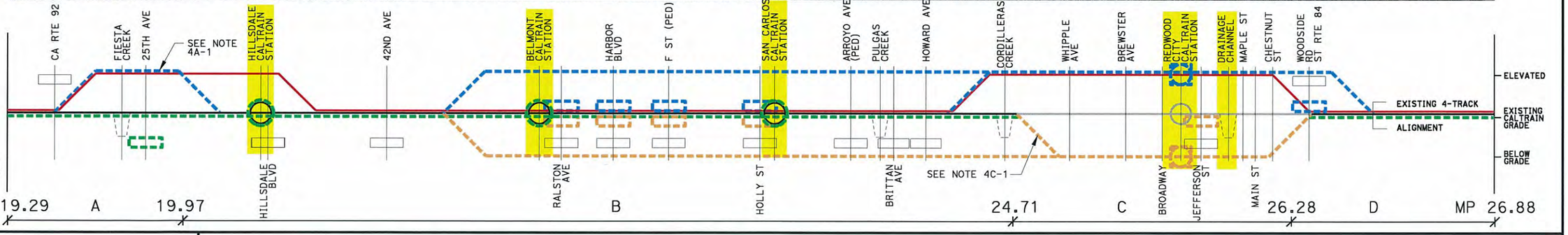
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





CALIFORNIA HIGH SPEED RAIL AUTHORITY
FLY CALIFORNIA
Without ever leaving the ground.

San Francisco - San Jose

DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

4.3.5 Subsection 4 – San Mateo, Belmont, San Carlos and Redwood City

Options Considered

- Subsection 4A – North of Highway 92 to South of 25th Avenue
  - At Grade
  - Berm
- Subsection 4B – South of 25th Avenue to South of Cordilleras Creek
  - Aerial Viaduct
  - Berm
  - At Grade
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 4C – South of Cordilleras Creek to North of Woodside Road
  - Aerial Viaduct
  - Berm
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 4D – North of Woodside Road to North of 5th Avenue
  - Aerial Viaduct (HST Only)
  - Berm
  - At Grade (Caltrain Only)
  - Open Trench (HST Only)
  - Covered Trench/Tunnel (HST Only)
  - Deep Tunnel (HST Only)

Vertical Profile Feasibility Notes

Note	Issue	Description
4A-1	Adjusted	25th Avenue would need to be partially lowered for the elevated option due to vertical curve constraints caused by horizontal curves.
4C-1	Adjusted	Unable to begin below grade transition after Cordilleras Creek due to clearance constraints at Whipple Avenue and transition is relocated to vicinity of Holly Street.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 4A: Berm. This would be a configuration where the tracks are partially elevated and 25th Avenue is partially depressed.
- 4B: Aerial Viaduct, Berm, At Grade, Covered Trench/Tunnel, and Deep Tunnel (HST Only). The Aerial Viaduct and Berm options in the segment between Highway 92 and 42nd Avenue would accommodate local plans for a transit-oriented development that call for 28th Avenue and 31st Avenue to extend across the Caltrain corridor. The transit-oriented development plan also includes the potential relocation of the Hillsdale Caltrain station approximately ¼ mile north of its present location. Aerial Viaduct, Berm, At Grade, Covered Trench/Tunnel, and Deep Tunnel (HST Only) would be options in the segment between 42nd Avenue and Cordilleras Creek, where the alignment begins to transition to the grade separation at Ralston Avenue. The Covered Trench/Tunnel and Deep Tunnel (HST Only) options would need to be below the existing storm drain crossing the Caltrain corridor near Harbor Boulevard.
- 4C: Aerial Viaduct, Open Trench, Covered Trench/Tunnel, Deep Tunnel (HST Only). This subsection includes the Redwood City Caltrain station, which is a location option for the potential Mid-Peninsula HST station. Caltrain would begin to transition separately from HST just south of the Redwood City station to allow for a Caltrain and freight connection to the Dumbarton branch and Port of Redwood City spur.
- 4D: Aerial Viaduct (HST Only), At Grade (Caltrain Only), Open Trench (HST Only), Covered Trench/Tunnel (HST Only), Deep Tunnel (HST Only). Caltrain would follow the At Grade option to allow for a Caltrain and freight connection to the Dumbarton branch and Port of Redwood City spur. HST would follow either the Aerial Viaduct, Open Trench, Covered Trench/Tunnel or Deep Tunnel options. The Aerial Viaduct (HST Only) option requires converting the Woodside Road overpass to an underpass. The Woodside Road overpass would be unchanged under the Open Trench, Covered Trench/Tunnel and Deep Tunnel options.

Options Not Carried Forward

The following options were not carried forward for the reasons listed below:

- 4A: The At Grade option is not practical due to the short transition distance between 25th Avenue and 28th Avenue.
- 4B: None.
- 4C -4D: The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option. An HST station is not practicable at this location under the Deep Tunnel (HST Only)

option because such a configuration presents constructability problems and would be exorbitantly expensive failing to meet the objective of minimizing capital cost.

Table 4-7
Summary Comparison of Design Options for Subsection 4 – San Mateo, Belmont, San Carlos, Redwood City

Evaluation Measure			4A - North of Highway 92 to South of 25th Avenue		4B - South of 25th Avenue to South of Cordilleras Creek				
			At Grade	Berm	Aerial Viaduct	Berm	At Grade	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options				
		Route length	Same for all options	Same for all options	Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Low	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than other options, due to ventilation, life safety, etc	Higher than other options, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	-	40 million	431 million	229-1,635 million	787 million	1,742 million	1,635 million
		Acquisition cost of additional ROW	Highest	Medium	Medium	Medium	Highest	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable	Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Construction would primarily occur within ultimate ROW; distance from Highway 92 to 25th Avenue is too short to make transition to aerial	Medium; Nominal width with TCE for this option is 107'. Approximately 70% of subsection has existing ROW less than 100'	Medium; Nominal width with TCE for this option is 102'. Approximately 55% of existing ROW less than 100'	Medium; Nominal width with TCE for this option is 107'. Approximately 55% of existing ROW less than 100'	Low; Construction would primarily occur within ultimate ROW	Medium; Nominal width with TCE for this option is 116'. Approximately 55% of existing ROW less than 100'	Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None	None	None				
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None	None			60" Storm drain pipe near Harbor Boulevard	None
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96'. Approximately 70% of subsection has existing ROW <80' and 30% over 100', impacts due to grade separation at 25th Avenue	Low; Nominal width for this option is 85'. Approximately 70% of subsection has existing ROW <80' and 30% over 100', impacts	Low; Nominal width for this option is 79'. Approximately 20% of subsection has existing ROW <70', 10% between 70'-79', and 70% over 80'	Low; Nominal width for this option is 85'. Approximately 30% of subsection has existing ROW <80', 10% between 80'-89' and 60% over 90'	Medium; Nominal width for this option is 96'. Approximately 40% of subsection has existing ROW <90', 20% between 90'-99' and 40% over 100', impacts due to grade adjustments at Ralston Avenue, Harbor Boulevard and Holly Street	Low; Nominal width for this option is 96'. Approximately 40% of subsection has existing ROW <90', 20% between 90'-99' and 40% over 100'	Low; Possibly some impacts due to ventilation structures

Evaluation Measure			4A - North of Highway 92 to South of 25th Avenue		4B - South of 25th Avenue to South of Cordilleras Creek				
			At Grade	Berm	Aerial Viaduct	Berm	At Grade	Covered Trench/Tunnel	Deep Tunnel (HST Only)
	Properties with access affected	Properties with access affected	None	None	None	None	Access affected for properties due to grade adjustments at Ralston Avenue, Harbor Boulevard and Holly Street	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable	Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 traffic lane along Pacific Boulevard; Improved traffic conditions with grade separation at 25th Avenue	Loss of 1 traffic lane along Pacific Boulevard; Improved traffic conditions with grade separation at 25th Avenue	Loss of 1 to 4 traffic lanes along Pacific Boulevard	Loss of 1 to 4 traffic lanes along Pacific Boulevard	Loss of 1 to 4 traffic lanes along Pacific Boulevard	Loss of 1 to 4 traffic lanes along Pacific Boulevard	None
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	0.40 acres	0.40 acres	Lower impacts than Berm option	Lower impacts than Trench option	Lower impacts than Trench option	0.31 acres	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None	None				
	Cultural resources	Number of historic structures within ultimate ROW	None	None	3	3	3	3	Lower impacts than other options, depending on siting of vent structures and tunnel portals
		Archeological Sensitivity (identified as present or not)	Present	Present	Present; lower impacts than Covered Trench/Tunnel option	Present; lower impacts than Covered Trench/Tunnel option	Present; lower impacts than Covered Trench/Tunnel option	Present	Present; lower impacts than other options, depending on the siting of vent structures, tunnel portals, and tunnel depth
	Parklands	Acres of parklands within ultimate ROW	0.04	0.04	None	None	None	None	None
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable				
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	Lower impacts than Berm option	R=21-40, I<5, M<5, P<5	R=501-700, I<=5, S<5, P<5	R R=501-700, I<=5, S<5P=11-20; M=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than Berm option	R=11-20, I<5, M<5, P<5	Lower impacts than At Grade options	Lower impacts than At Grade option	R=201-300, S<5	Lower impacts than Berm and Aerial Viaduct options	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures, tunnel portals, and tunnel depth

Evaluation Measure			4A - North of Highway 92 to South of 25th Avenue		4B - South of 25th Avenue to South of Cordilleras Creek				
			At Grade	Berm	Aerial Viaduct	Berm	At Grade	Covered Trench/Tunnel	Deep Tunnel (HST Only)
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	P<5	P<5	R=101-200	R=101-200	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	None	None	5	5	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	12%	12%	1%	1%	1%	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	0/8	0/8	Lower impacts than Covered Trench/Tunnel option	Lower impacts than Covered Trench/Tunnel option	Lower impacts than Covered Trench option	4/40	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures, tunnel portals, and tunnel depth

Subsection 4 (continued)

Evaluation Measure			4C - South of Cordilleras Creek to North of Woodside Road					4D - North of Woodside Road to North of 5th Avenue					
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only)	Berm	At Grade (Caltrain Only)	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options			Same for all options	Same for all options	Same for all options			
		Route length	Same for all options	Same for all options	Same for all options			Same for all options	Same for all options	Same for all options			
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable			Same for all options	Same for all options	Same for all options			
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm option, due to aerial structure	Lowest	Higher than Berm option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	157-447 million	-	325 million	765 million	447 million	37 million	-	37-159 million	112 million	159 million	128 million
		Acquisition cost of additional ROW	Medium	Medium	Medium	Lowest	Lowest	Medium	Medium	Highest	Medium	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for all options except Deep Tunnel (Potential Redwood City station in this subsection)	Same for all options except Deep Tunnel (Potential Redwood City station in this subsection)	Same for all options except Deep Tunnel (Potential Redwood City station in this subsection)			Not applicable	Not applicable	Not applicable			
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Inconsistent with adopted plans and policies; strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and	Inconsistent with adopted plans and policies			Consistent with adopted plans and policies	Inconsistent with adopted plans and policies; strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and	Inconsistent with adopted plans and policies	Consistent with adopted plans and policies		

Evaluation Measure			4C - South of Cordilleras Creek to North of Woodside Road					4D - North of Woodside Road to North of 5th Avenue					
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only)	Berm	At Grade (Caltrain Only)	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
				land uses					land uses				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Medium; Nominal width with TCE for this option is 103'. Approximately 90% of existing ROW less than 100'	Medium; Nominal width with TCE for this option is 109'. Approximately 90% of existing ROW less than 100'	Medium; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	Medium; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Existing ROW less than 100' throughout this subsection	Low; Nominal width with TCE for this option is 109'. Existing ROW less than 100' throughout this subsection	Low; Construction would primarily occur within ultimate ROW	Low; Existing ROW less than 100' throughout this subsection	Low; Existing ROW less than 100' throughout this subsection	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Redwood City Harbor Lead	Redwood City Harbor Lead	Redwood City Harbor Lead			Redwood Junction Leads (Dumbarton Line)	Redwood Junction Leads (Dumbarton Line)	Redwood Junction Leads (Dumbarton Line)			
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None	None			None	None	None			
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Approximately 45% of subsection has existing ROW <70' and 55% over 80'	Low; Nominal width for this option is 85'. Approximately 45% of subsection has existing ROW <70', 45% between 80'-89' and 10% over 100'	Low; Nominal width for this option is 96'. Approximately 90% of subsection has existing ROW <90' and 10% over 100'	Low; Nominal width for this option is 96'. Approximately 90% of subsection has existing ROW <90' and 10% over 100'; Possibly some due to ventilation structures	Possibly some due to ventilation structures	Low; Approximately 50% of subsection has existing ROW between 70'-79' and 50% over 80'	Low; Nominal width for this option is 85'. Approximately 50% of subsection has existing ROW <80' and 50% between 80'-89'	Low; Approximately 50% of subsection has existing ROW between 70'-79' and 50% over 80'	Low; Approximately 50% of subsection has existing ROW between 70'-79' and 50% over 80'	Low; Approximately 50% of subsection has existing ROW between 70'-79' and 50% over 80'	Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	None			None	None	None			
	Local traffic effects around station	Increase in traffic congestion	Same for all options	Same for all options	Same for all options			Not applicable	Not applicable	Not applicable			
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 to 2 traffic lanes along Old Country Road	Loss of 1 to 2 traffic lanes along Old Country Road; Does not enhance connectivity and mobility as well as an aerial viaduct	Loss of 1 to 2 traffic lanes along Old Country Road	Loss of 1 to 2 traffic lanes along Old Country Road	None	None	None	None			

Evaluation Measure			4C - South of Cordilleras Creek to North of Woodside Road					4D - North of Woodside Road to North of 5th Avenue					
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only)	Berm	At Grade (Caltrain Only)	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
				option or trench or tunnel option									
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm options	Lower impacts than Trench options	0.13 acres	0.13 acres	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	None	None	None			
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None	None			None	None	None			
	Cultural resources	Number of historic structures within ultimate ROW	5	5	5	5	Lower impacts than other options, depending on siting of vent structures and tunnel portals	None	None	None			
		Archeological Sensitivity (identified as present or not)	Present	Present	Present			None	None	None			
	Parklands	Acres of parklands within ultimate ROW	0.06 (two parks)	0.06 (two parks)	0.06 (two parks)	0.06 (two parks)	Lower impacts than other options, depending on siting of vent structures and tunnel portals	None	None	None			
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable			Not applicable	Not applicable	Not applicable			

Evaluation Measure			4C - South of Cordilleras Creek to North of Woodside Road					4D - North of Woodside Road to North of 5th Avenue					
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only)	Berm	At Grade (Caltrain Only)	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=301-500, I=5-10, M=5-10, S<5, P=5-10	R=301-500, I=5-10, M=5-10, S<5, P=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Open Trench option	Lower impacts than Covered Trench option, depending on siting of vent structures and tunnel portals	R=21-40, M<5, P<5	R=21-40, M<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Open Trench option	Lower impacts than Open Trench option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=201-300, I<5, M<5, S<5, P<5	R=201-300, I<5, M<5, S<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than At Grade option	Lower impacts than At Grade option	R=11-20, M<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options depending on siting of vent structures, tunnel portals and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=61-100, P<5	R=61-100, P<5; Strong community perception of significant "barrier effect" from berm structure though this area	Minimal impacts	Minimal impacts	None	R=5-10	R=5-10; Strong community perception of significant "barrier effect" from berm structure though this area	R=5-10	Minimal impacts	Minimal impacts	None
		Number of scenic roadways that cross the ROW	None	None	None			None	None	1	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	3%	3%	Minimal impacts, lower impacts than Aerial Viaduct and Berm options	Minimal impacts, lower impacts than Aerial Viaduct and Berm options	Minimal impacts, lower impacts than Aerial Viaduct and Berm options	0%	0%	0%	0%	0%	0%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	6/29	6/29	Lower impacts than Trench options	None	None	None			

Subsection #5

Length: 2.8 miles Land Use: Urban

North of 5th Avenue to North of SCL/SM County Line (MP. 26.88 to MP. 29.72)
This subsection is located in the Cities of Atherton and Menlo Park, with a small portion in unincorporated San Mateo County. The Caltrain tracks are at-grade, and with one exception, all street crossings are at-grade. Generally, the streets that cross the tracks are two-lane collectors serving residential areas. In most cases, these streets are integral parts of the local street network.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

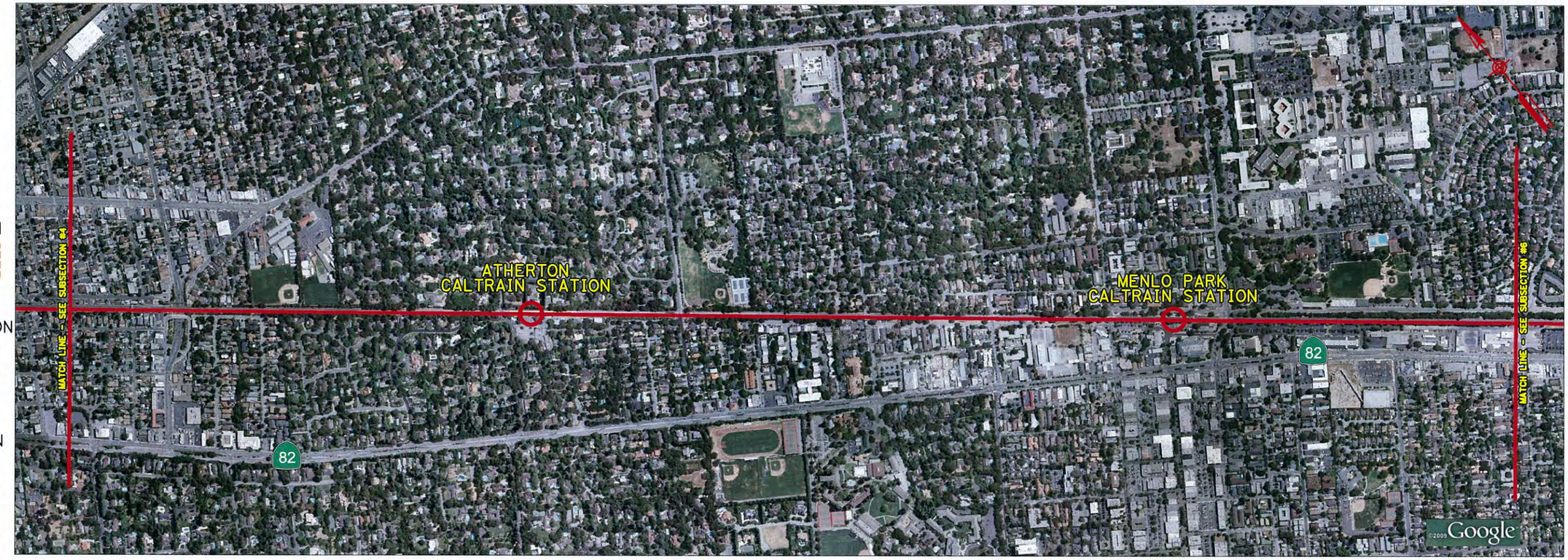
CALTRAIN STATION DESIGN OPTION

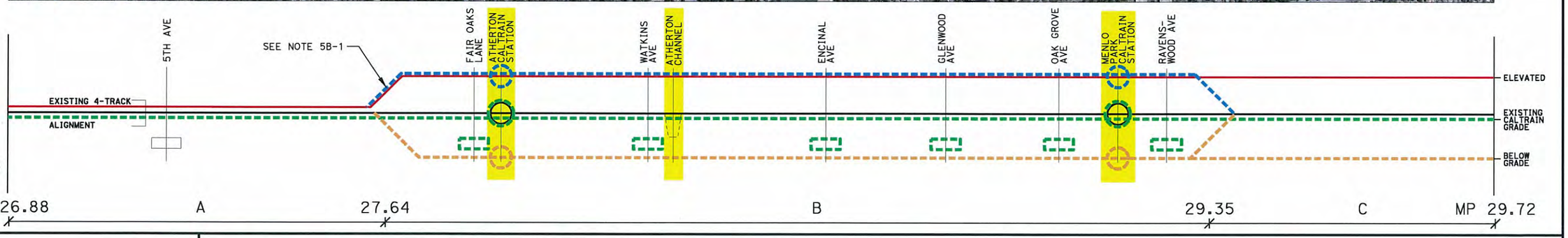
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.6 Subsection 5 – Atherton and Menlo Park

Options Considered

- Subsection 5A – North of 5th Avenue to South of 5th Avenue
  - At Grade
  - Deep Tunnel (HST Only)
- Subsection 5B – South of 5th Avenue South of Ravenswood Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 5C – South of Ravenswood Avenue to North of San Mateo County/Santa Clara County Line
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)

Vertical Profile Feasibility Notes

Note	Issue	Description
5B-1	Adjusted	Unable to begin elevated transition from at-grade after 5th Ave due to clearance constraints (to avoid roadway modification) at Fair Oaks Avenue.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 5A: At Grade, Deep Tunnel (HST Only).
- 5B: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel, Deep Tunnel (HST Only). The Open Trench, Covered Trench/Tunnel and Deep Tunnel (HST Only) options would need to be below the existing utilities in the roadways crossing the corridor as well as below the Atherton Channel.
- 5C: At Grade, Covered Trench/Tunnel, Deep Tunnel (HST Only). The hotel on the west side of the corridor, just north of San Francisquito Creek, would be affected for the 4-track Covered Trench/Tunnel option.

Options Not Carried Forward

The following options were not carried forward for the reasons listed below:

- 5A: None.
- 5B: The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option.
- 5C: The Open Trench option would have substantial impacts on San Francisquito Creek and the El Palo Alto tree.

Table 4-8
Summary Comparison of Design Options for Subsection 5 – Atherton, Menlo Park

Evaluation Measure			5A - North of 5th Avenue to South of 5th Avenue		5B - South of 5th Avenue to South of Ravenswood Avenue					
			At Grade	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options		Same for all options	Same for all options	Same for all options			
		Route length	Same for all options		Same for all options	Same for all options	Same for all options			
	Maximize connectivity and accessibility	Intermodal connections	Not applicable		Not applicable	Not applicable	Not applicable			
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Higher than At Grade option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	11-160 million	160 million	168-690 million	-	98-563 million	355-867 million	833-998 million	563-998 million
		Acquisition cost of additional ROW	Highest	Lowest	Medium	Medium	Highest	Medium	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable		Not applicable	Not applicable	Not applicable			
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies			
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Construction would primarily occur within ultimate ROW	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Medium; Nominal width with TCE for this option is 103'. Existing ROW less than 100' throughout this subsection	Medium; Nominal width with TCE for this option is 109'. Existing ROW less than 100' throughout this subsection	Low; Construction would primarily occur within ultimate ROW	Medium; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection	Medium; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None		None	None	None			
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None		None	None	None			

Evaluation Measure			5A - North of 5th Avenue to South of 5th Avenue		5B - South of 5th Avenue to South of Ravenswood Avenue					
			At Grade	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96'. Existing ROW <90' throughout this subsection	Low; Possibly some due to ventilation structures	Medium; Nominal width for this option is 79'. Approximately 15% of subsection has existing ROW <70', 20% between 70'-79' and 65% over 80'	Medium; Nominal width for this option is 85'. Approximately 35% of subsection has existing ROW <80' and 65% between 80'-90'	High; Nominal width for this option is 96'. Existing ROW <90' throughout this subsection, also impacts due to grade separations at Fair Oaks Lane, Watkins Avenue, Encinal Avenue, Glenwood Avenue, Oak Grove Avenue and Ravenswood Avenue	Medium; Nominal width for this option is 96'. Existing ROW <90' throughout this subsection	Medium; Nominal width for this option is 96. Existing ROW <90' throughout this subsection; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None		None	None	Access for properties affected due to grade separations	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable		Not applicable	Not applicable	Not applicable			
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None		Loss of one traffic lane on Alma Street between Oak Grove Avenue and Ravenswood Avenue; improved traffic conditions with grade separations at Fair Oaks Lane, Watkins Avenue, Encinal Avenue, Glenwood Avenue, Oak Grove Avenue and Ravenswood Avenue	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option			Improved traffic conditions with grade separations at Fair Oaks Lane, Watkins Avenue, Encinal Avenue, Glenwood Avenue, Oak Grove Avenue and Ravenswood Avenue
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None		Lower impacts than Berm option	Lower impacts than Trench options	Lower impacts than Trench options	0.04 acres	0.04 acres	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None		None	None	None			
	Cultural resources	Number of historic structures within ultimate ROW	None		5	5	53	5	5	Lower impacts than other options, depending on siting of vent structures and tunnel portals
		Archeological Sensitivity (identified as present or not)	None		Present	Present	Present			

Evaluation Measure			5A - North of 5th Avenue to South of 5th Avenue		5B - South of 5th Avenue to South of Ravenswood Avenue					
			At Grade	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
	Parklands	Acres of parklands within ultimate ROW	None		0.53 (two facilities)	0.53 (two facilities)	0.53 (two facilities)	0.53 (two facilities)	0.53 (two facilities)	Lower impacts than other options, depending on siting of vent structures and tunnel portals
	Agricultural lands	Acres of farmland	Not applicable		Not applicable	Not applicable	Not applicable			
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300,P=5-10; M<5	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	R=301-500, I<5, M<5, S<5, P<5	R=301-500, I<5, M<5, S<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=101-200, P<5	Lower impacts than At Grade option	Lower impacts than At Grade option	Lower impacts than At Grade option	R=201-300, I<5-, M<5, S<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=41-60	Minimal impacts	R=101-200, I<5, P<5, S<5	R=101-200, I<5, P<5, S<5; Strong community perception of significant “barrier effect” from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	None	None	1	1	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	0%	0%	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	None		Lower impacts than Trench options	Lower impacts than Trench options	Lower impacts than Trench options	1/5	1/5	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth

Subsection 5 Continued

Evaluation Measure			5C - South of Ravenswood Avenue to North of San Mateo County/Santa Clara County Line			
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options	
		Route length	Same for all options	Same for all options	Same for all options	
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable	
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Lowest	Higher than At Grade option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	20-687 million	-	588-1,281 million	687-1,281 million
		Acquisition cost of additional ROW	Highest	Medium	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable	Not applicable	
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Consistent with adopted plans and policies	
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 90% of existing ROW over 100'. Public ROW available	Low; Nominal width with TCE for this option is 120'. Approximately 90% of existing ROW over 100'. Public ROW available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None	None	None	
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None	None	
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW <90' and 90% over 100'	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW between 80'-90' and 90% over 100'	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW between 80'-90' and 90% over 100'	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Possibly some due to ventilation structures	Possibly some due to ventilation structures
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable	Not applicable	
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None	None	None	

Evaluation Measure			5C - South of Ravenswood Avenue to North of San Mateo County/Santa Clara County Line			
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None	Would have adverse effects on San Francisquito Creek in Subsection 6A	None	
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	Would have adverse effects on San Francisquito Creek in Subsection 6A	None	
	Cultural resources	Number of historic structures within ultimate ROW	None	None	None	
		Archeological Sensitivity (identified as present or not)	None	None	None	
	Parklands	Acres of parklands within ultimate ROW	None	None	None	
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable	
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	I/P<5	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	None	None	None	
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	None	None	None	
		Number of scenic roadways that cross the ROW	None	None	None	
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	No impacts	No impacts	
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	None	None	None	

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Subsection #6

Length: 3.9 miles Land Use: Urban

North of SCL/SM County Line to North of Adobe Creek (MP. 29.72 to MP. 33.61)
This subsection is located in the City of Palo Alto. The Caltrain tracks are at-grade and all of the streets that are grade separated pass under the tracks. Several at-grade crossings occur between the grade separations. Alma Street runs alongside the Caltrain tracks for the entire length of this subsection.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

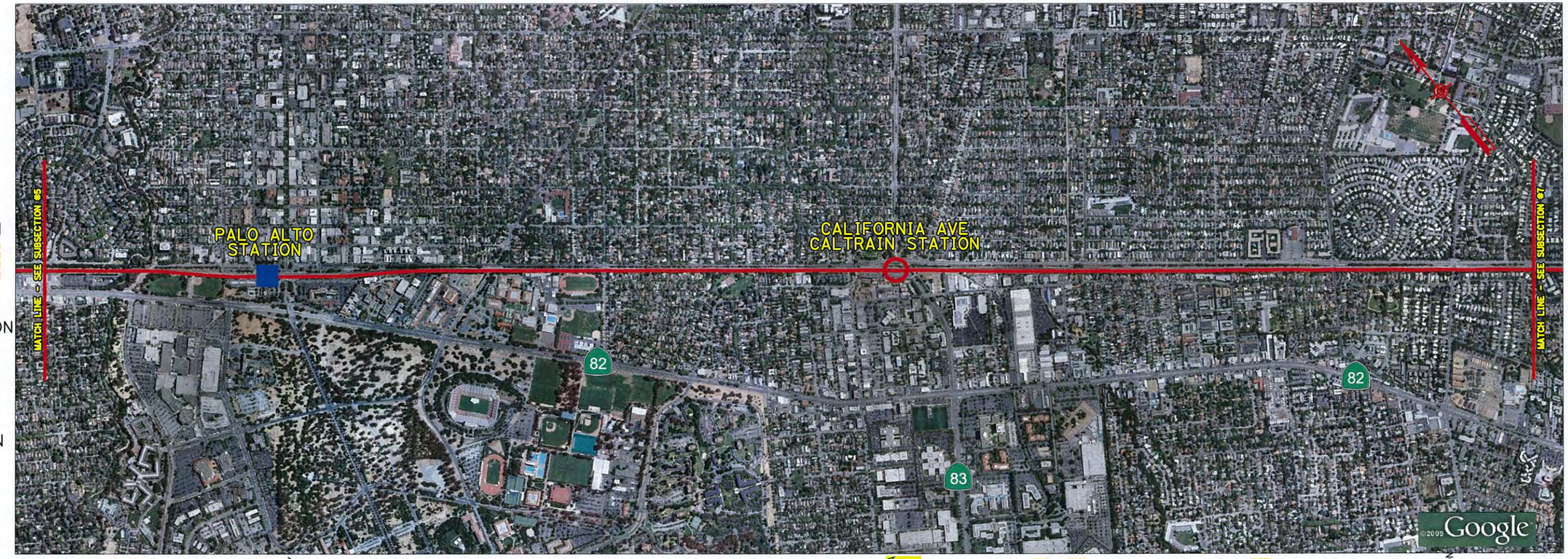
CALTRAIN STATION DESIGN OPTION

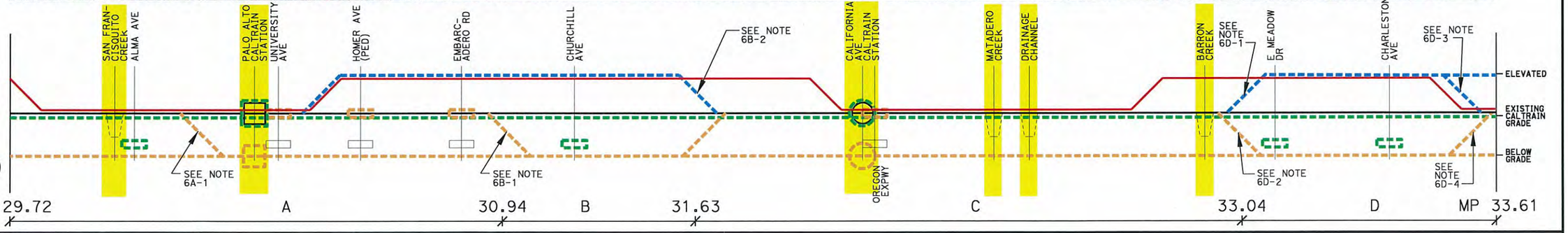
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.7 Subsection 6 – Palo Alto

Options Considered

- Subsection 6A – North of San Mateo County/Santa Clara County Line to South of Embarcadero Road
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST only)
- Subsection 6B – South of Embarcadero Road to South of Churchill Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 6C – South of Churchill Avenue to North of East Meadow Drive
  - Aerial Viaduct
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 6D – North of East Meadow Drive to North of Adobe Creek
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)

Vertical Profile Feasibility Notes

Note	Issue	Description
6A-1	Eliminated	Limited room between horizontal curves and potential HST Station (Palo Alto Caltrain Station).
6B-1	Eliminated	Unable to clear Churchill due to horizontal curves.
6B-2	Adjusted	Unable to meet at grade before California Avenue Caltrain Station due to clearance of Churchill Avenue.
6D-1	Adjusted	Unable to start vertical curve after Barron Creek due to horizontal curves and California Avenue Caltrain station.
6D-2	Eliminated	Unable to clear East Meadow Drive completely and unable to extend further back due to Barron Creek.
6D-3	Adjusted	Unable to meet at grade before Adobe Creek due to Charleston Road clearance and horizontal curves.
6D-4	Adjusted	Unable to meet at grade before Adobe Creek due Barron Creek clearance.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 6A: At Grade, Covered Trench/Tunnel, Deep Tunnel (HST Only). This subsection includes the Palo Alto Caltrain station, which is a location option for the potential Mid-Peninsula HST station.
- 6B-6D: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel, Deep Tunnel (HST Only).

Options Not Carried Forward

The following options were not carried forward for the reasons listed below:

- 6A: Aerial Viaduct, Open Trench, Berm. The Aerial Viaduct and Open Trench options would have substantial impacts on the existing El Palo Alto tree, San Francisquito Creek, and the historic Palo Alto Caltrain station. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option. An HST station is not practicable at this location under the Deep Tunnel (HST Only) option because such a configuration presents constructability problems and would be exorbitantly expensive failing to meet the objective of minimizing capital cost.
- 6B: The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option.
- 6C: None.
- 6D: The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option.

Table 4-9
Summary Comparison of Design Options for Subsection 6 – Palo Alto

Evaluation Measure			6A - North of San Mateo County/Santa Clara County Line to South of Embarcadero Road					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options	Same for all options	Same for all options	
		Route length	Same for all options	Same for all options	Same for all options	Same for all options	Same for all options	
	Maximize connectivity and accessibility	Intermodal connections	Same for all options	Same for all options	Same for all options	Same for all options	Same for all options	
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	-	-	75-290 million	-	599 million	290 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Medium	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for all options (Potential Palo Alto HST station in this subsection)	Same for all options (Potential Palo Alto HST station in this subsection)	Same for all options (Potential Palo Alto HST station in this subsection)	Same for all options (Potential Palo Alto HST station in this subsection)	Same for all options (Potential Palo Alto HST station in this subsection)	
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Consistent with adopted plans and policies	
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 75% of existing ROW is over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Approximately 75% of existing ROW is over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW is over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW is over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Evaluation Measure			6A - North of San Mateo County/Santa Clara County Line to South of Embarcadero Road					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Existing ROW over 80' throughout this subsection	Low; Nominal width for this option is 85'. Approximately 25% of subsection has existing ROW between 80'-89' and 75% over 100'	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100', possible impacts due to grade separation at Alma Street	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100'	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100', Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separation at Alma Street	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Same for all options (Potential Palo Alto HST station in this subsection)	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 traffic lane along Alma Street; improved traffic conditions with grade separation at Alma Street	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Improved traffic conditions with grade separation at Alma Street
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm option	Lower impacts than Trench options	Lower impacts than Trench options	0.06	0.06	Lower impacts than Aerial Viaduct options, depending on siting of vent structures, tunnel portals, and tunnel depth
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	Present, would have adverse effects on San Francisquito Creek; lower impacts than Berm option	Present, San Francisquito Creek; lower impacts than Trench options	Present, San Francisquito Creek; lower impacts than Trench options	Present, would have adverse effects on San Francisquito Creek	Present, San Francisquito Creek	Present, San Francisquito Creek; lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth
	Cultural resources	Number of historic structures within ultimate ROW	3	3	3	3	3	Lower impacts than other options, depending on siting of vent structures and tunnel portals
		Archeological Sensitivity (identified as present or not)	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present	Present	Present; Lower impacts than other options, depending on siting of vent structures, tunnel portals, and tunnel depth
	Parklands	Acres of parklands within ultimate ROW	0.25 (two facilities)	0.25 (two facilities)	0.25 (two facilities)	0.25 (two facilities)	0.25 (two facilities)	Lower impacts than other options, depending on siting of vent structures and tunnel portals
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Evaluation Measure			6A - North of San Mateo County/Santa Clara County Line to South of Embarcadero Road					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I=5-10, M<5, S<5,P=5-10	R=201-300, I=5-10, M<5, S<5,P=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, I<5, M<5, S<5, P=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	None	Strong community perception of significant “barrier effect” from berm structure though this area	R=101-200	Minimal impacts	Minimal impacts	
		Number of scenic roadways that cross the ROW	1	1	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	21%	21%	21%	Minimal impacts	Minimal impacts	
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	Lower impacts than Trench options	1/8	1/8	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth

Subsection 6 Continued

Evaluation Measure			6B - South of Embarcadero Road to South of Churchill Avenue					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options			
		Route length	Same for all options	Same for all options	Same for all options			
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable			
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	52-184 million	-	41-176 million	123 million	321 million	176-184 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Medium	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable	Not applicable			
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies			
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Existing ROW less than 100' throughout this subsection. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Existing ROW less than 100' throughout this subsection. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection. Public ROW is available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable	Not applicable	Not applicable			
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None	None	Two 24" RCP water lines near Churchill Avenue	Two 24" RCP water lines near Churchill Avenue	None

Evaluation Measure			6B - South of Embarcadero Road to South of Churchill Avenue					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Approximately 25% of subsection has existing ROW <70', 40% between 70'-79' and 35% over 80'	Low; Nominal width for this option is 85'. Approximately 65% of subsection has existing ROW <80' and 35% between 80'-89'	Medium; Nominal width for this option is 96'. Existing ROW is <90' throughout this subsection and possible impacts due to grade separation at Churchill Avenue	Low; Nominal width for this option is 96'. Existing ROW is <90' throughout this subsection	Low; Nominal width for this option is 96'. Existing ROW is <90' throughout this subsection; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separation at Churchill Avenue	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable	Not applicable			
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 2 traffic lanes along Alma Street; improved traffic conditions with grade separation at Churchill Avenue	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option			Improved traffic conditions with grade separation at Churchill Avenue
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None	None	None			
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None	None			
	Cultural resources	Number of historic structures within ultimate ROW	1	1	1	1	1	Lower impacts than other options, depending on siting of vent structures and tunnel portals
		Archeological Sensitivity (identified as present or not)	None	None	None			
	Parklands	Acres of parklands within ultimate ROW	0.17	0.17	0.17	0.17	0.17	Lower impacts than other options, depending on siting of vent structures and tunnel portals
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable			
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, S<5, P<5	R=201-300, S<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth

Evaluation Measure			6B - South of Embarcadero Road to South of Churchill Avenue					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=61-100	R=65; Strong community perception of significant “barrier effect” from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	None	None	None			
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	None	None	None			

Subsection 6 Continued

Evaluation Measure			6C - South of Churchill Avenue to North of East Meadow Drive				
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options				
		Route length	Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Lowest	Higher than At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	133-406 million	46-302 million	278 million	694 million	302-406 million
		Acquisition cost of additional ROW	Medium	Highest	Medium	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 50% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 50% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 50% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable				
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable				
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Existing ROW is >80' throughout this subsection	Low; Nominal width for this option is 96'. Approximately 55% of subsection has existing ROW <90' and 45% is over 100'	Low; Nominal width for this option is 96'. Approximately 55% of subsection has existing ROW <90' and 45% is over 100'	Low; Nominal width for this option is 96'. Approximately 55% of subsection has existing ROW <90' and 45% is over 100'; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None				
	Local traffic effects around station	Increase in traffic congestion	Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 to 2 traffic lanes along Alma Street				None
Environmental Resources	Waterways and wetlands and natural preserves or	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Trench options	Lower impacts than Trench options	0.25 acres	0.25 acres	Lower impacts than At-Grade option

Evaluation Measure			6C - South of Churchill Avenue to North of East Meadow Drive				
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
	biologically sensitive habitat areas affected	Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None				
	Cultural resources	Number of historic structures within ultimate ROW	None				
		Archeological Sensitivity (identified as present or not)	Present; Lower impacts than Trench options	Present; Lower impacts than Trench options	Present	Present	Present; Lower impacts than Trench options
	Parklands	Acres of parklands within ultimate ROW	None				
	Agricultural lands	Acres of farmland	Not applicable				
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, S<5, P<5	Lower impacts than Aerial Viaduct option	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	R=101-200; I<5; P<5	Lower impacts than At Grade option	Lower impacts than At Grade option	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200; P<5	Lower impacts than Aerial Viaduct option	Minimal impacts		
		Number of scenic roadways that cross the ROW	1	1	Minimal impacts		
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	1%	1%	Minimal impacts		
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	2/6	2/6	Lower impacts than Trench options, depending on the siting of vent structures, tunnel portals, and tunnel depth

Subsection 6 Continued

Evaluation Measure			6D - North of East Meadow Drive to North of Adobe Creek					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options			
		Route length	Same for all options	Same for all options	Same for all options			
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable			
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	44-154 million	-	112-186 million	112 million	272 million	154-186 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Medium	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable	Not applicable			
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies			
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 75% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Approximately 75% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable	Not applicable	Not applicable			
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable	Not applicable	Not applicable			

Evaluation Measure			6D - North of East Meadow Drive to North of Adobe Creek					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Existing ROW is >80' throughout this subsection	Low; Nominal width for this option is 85'. Approximately 25% of subsection has existing ROW between 80'-89' and 75% is over 100'	Medium; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100', impacts due to grade separations at East Meadow Drive and Charleston Road	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100'	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100'; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separations at East Meadow Drive and Charleston Road	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable	Not applicable			
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Improved traffic conditions with grade separations at East Meadow Drive and Charleston Road	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option			
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm option	Lower impacts than Trench options	Lower impacts than Trench options	0.04	0.04	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None	None			
	Cultural resources	Number of historic structures within ultimate ROW	None	None	None			
		Archeological Sensitivity (identified as present or not)	Present; Lower impacts than Trench options	Present; Lower impacts than Trench options	Present; Lower impacts than Trench options	Present	Present	Present; Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth
	Parklands	Acres of parklands within ultimate ROW	None	None	None	None	None	None
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable			
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, P<5	R=201-300, I<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth

Evaluation Measure			6D - North of East Meadow Drive to North of Adobe Creek					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200	R=101-200; Strong community perception of significant "barrier effect" from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	1	1	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	None	None	None			

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Subsection #7

Length: 5.7 miles Land Use: Urban

North of Adobe Creek to North of Fair Oaks Avenue (MP. 33.61 to MP. 39.29)
This subsection is located in the Cities of Mountain View and Sunnyvale. The Caltrain tracks are at-grade and all grade separated crossings pass over the tracks. Several at-grade crossings occur between the grade separations. Central Expressway and Evelyn Avenue run alongside the Caltrain tracks for a large portion of this subsection.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

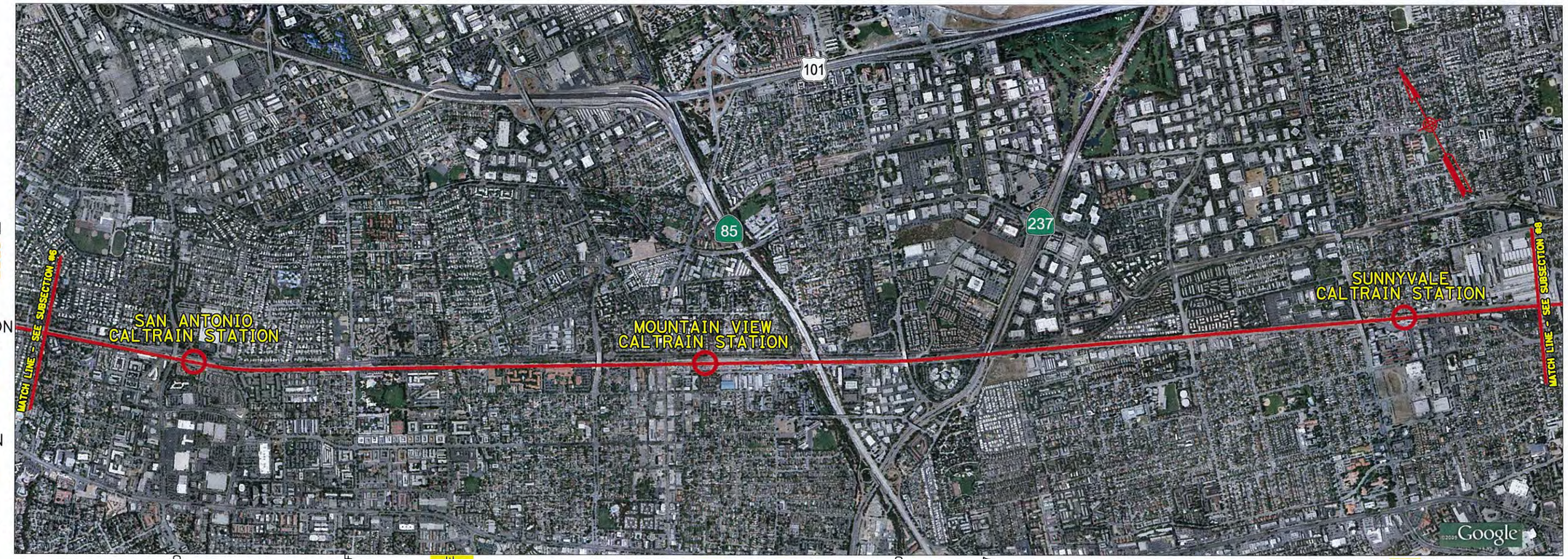
CALTRAIN STATION DESIGN OPTION

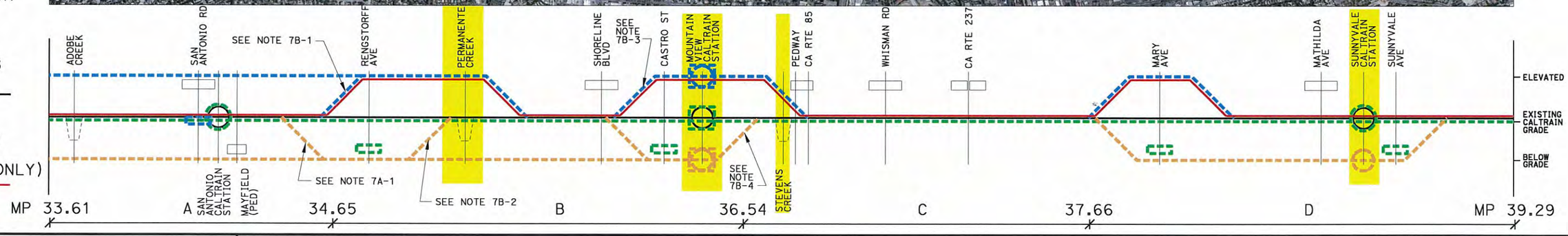
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





CALIFORNIA HIGH SPEED RAIL AUTHORITY
FLY CALIFORNIA
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San Francisco - San Jose

DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

4.3.8 Subsection 7 – Mountain View and Sunnyvale

Options Considered

- Subsection 7A-7B – North of Adobe Creek to North of Stevens Creek
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
- Subsection 7C-7D – North of Stevens Creek to North of Fair Oaks Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel

Vertical Profile Feasibility Notes

Note	Issue	Description
7A-1	Adjusted	Unable to start vertical curve after San Antonio station due to horizontal curves.
7B-1	Adjusted	Unable to clear Rengstorff Avenue due to horizontal curves and San Antonio station.
7B-2	Eliminated	Unable to meet at grade and clear Rengstorff Avenue.
7B-3	Adjusted	Unable to clear Castro Street completely due to Shoreline Boulevard. Shoreline Boulevard would have to be moved to grade.
7B-4	Adjusted	Unable to meet grade before Stevens Creek due to limited space between Stevens Creek and Mountain View station.

Options Carried Forward

The Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel options have been identified to be carried forward into further engineering and environmental analysis. This subsection includes the Mountain View Caltrain station, which is a location option for the potential Mid-Peninsula HST station. The Aerial Viaduct option requires converting the San Antonio Road and Shoreline Boulevard overpasses to at grade configurations.

Options Not Carried Forward

The Berm option was not carried forward because it does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option.

Table 4-10
Summary Comparison of Design Options for Subsection 7 – Mountain View, Sunnyvale

Evaluation Measure			7A & 7B - North of Adobe Creek to North of Stevens Creek				
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options		
		Route length	Same for all options	Same for all options	Same for all options		
	Maximize connectivity and accessibility	Intermodal connections	Same for all options	Same for all options	Same for all options		
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	344 million	-	155 million	615 million	1,433 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Medium	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for all options (Potential Mountain View HST station in this subsection)	Same for all options (Potential Mountain View HST station in this subsection)	Same for all options (Potential Mountain View HST station in this subsection)		
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies		
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 60% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Approximately 60% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 60% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 60% of existing ROW over 100'. Public ROW is available
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable	Not applicable	Not applicable		
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable	Not applicable	Not applicable		
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Exiting ROW is >90' throughout this subsection	Low; Nominal width for this option is 85'. Exiting ROW is >90' throughout this subsection	Medium; Nominal width for this option is 96'. Approximately 40% of subsection has exiting ROW between 90'-99' and 60% over 100' and impacts due to the grade separations at Rengstorff Avenue and Castro Street	Low; Nominal width for this option is 96'. Approximately 40% of subsection has exiting ROW between 90'-99' and 60% over 100'	Low; Nominal width for this option is 96'. Approximately 40% of subsection has exiting ROW between 90'-99' and 60% over 100'; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separations at Rengstorff Avenue and Castro Street	None	None

Evaluation Measure			7A & 7B - North of Adobe Creek to North of Stevens Creek				
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel
	Local traffic effects around station	Increase in traffic congestion	Same for all options (Potential Mountain View HST Station in this subsection)	Same as Aerial Viaduct option	Same as Aerial Viaduct option		
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of one traffic lane along Central Expressway, north of Rengstorff Avenue; improved traffic conditions with grade separations at Rengstorff Avenue and Moffett Boulevard	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option		
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than the Berm option	Lower impacts than the Trench options	Lower impacts than the Trench options	0.07	0.07
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	Present, Permanente Creek; lower impacts than Berm option	Present, Permanente Creek; lower impacts than Trench options	Present, Permanente Creek; lower impacts than Trench options	Present, Permanente Creek	Present, Permanente Creek
	Cultural resources	Number of historic structures within ultimate ROW	None	None	None		
		Archeological Sensitivity (identified as present or not)	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present	Present
	Parklands	Acres of parklands within ultimate ROW	None	None	None		
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable		
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=301-500, I=5-10, P<5	R=301-500, I=5-10, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=201-300, I<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200, P<5	R=101-200, P<5; Strong community perception of significant “barrier effect” from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	
		Number of scenic roadways that cross the ROW	5	5	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	1%	1%	1%	Minimal impacts	
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	Lower impacts than Trench options	1/7	1/7

Subsection 7 Continued

Evaluation Measure			7C & 7D - North of Stevens Creek to North of Fair Oaks Avenue				
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options		
		Route length	Same for all options	Same for all options	Same for all options		
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable		
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	99 million	-	107 million	540 million	1,323 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Medium	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable	Not applicable		
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies		
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 85% of existing ROW is less than 100'. Public ROW is available
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable	Not applicable	Not applicable		
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable	Not applicable	Not applicable		
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Medium; Nominal width for this option is 79'. Approximately 10% of subsection has existing ROW <70', 60% between 70'-79' and 30% over 80'	Medium; Nominal width for this option is 85'. Approximately 70% of subsection has existing ROW <80', 10% between 80'-89' and 20% over 90'	Medium; Nominal width for this option is 96'. Approximately 80% of subsection has existing ROW <90', 5% between 90'-99' and 15% over 100'; impacts due to grade separations at Mary Avenue and Sunnyvale Avenue	Medium; Nominal width for this option is 96'. Approximately 80% of subsection has existing ROW <90', 5% between 90'-99' and 15% over 100'	Medium; Nominal width for this option is 96'. Approximately 80% of subsection has existing ROW <90', 5% between 90'-99' and 15% over 100'; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separations at Mary Avenue and Sunnyvale Avenue	None	None

Evaluation Measure			7C & 7D - North of Stevens Creek to North of Fair Oaks Avenue				
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable	Not applicable		
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of one traffic lane on Hendy Avenue; improved traffic conditions with grade separations at Mary Avenue and Sunnyvale Avenue	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option		
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None	None	None		
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None	None		
	Cultural resources	Number of historic structures within ultimate ROW	None	None	None		
		Archeological Sensitivity (identified as present or not)	None	None	None		
	Parklands	Acres of parklands within ultimate ROW	None	None	None		
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable		
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, S<5, M=5-10	R=201-300, I<5, S<5, M=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, M=5-10, S<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=41-60	R=41-60; Strong community perception of significant “barrier effect” from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	
		Number of scenic roadways that cross the ROW	0	0	2	Minimal impacts	
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	Minimal impacts	
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	Lower impacts than Trench options	0/5	0/5

Subsection #8

Length: 4.7 miles Land Use: Urban

North of Fair Oaks Avenue to North of De La Cruz Boulevard (MP. 39.29 to MP. 44.04)
This subsection is located in the Cities of Sunnyvale and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Most of the crossings pass over the tracks. This subsection includes an existing 4-track segment near Lawrence Expressway.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

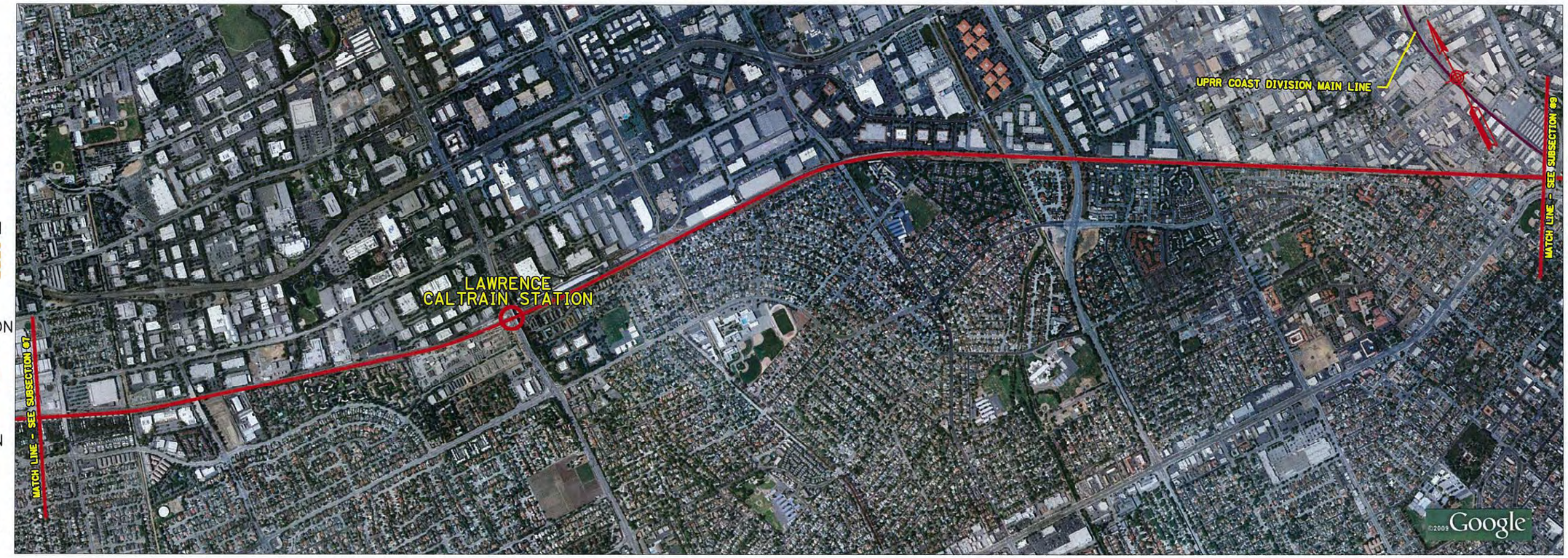
CALTRAIN STATION DESIGN OPTION

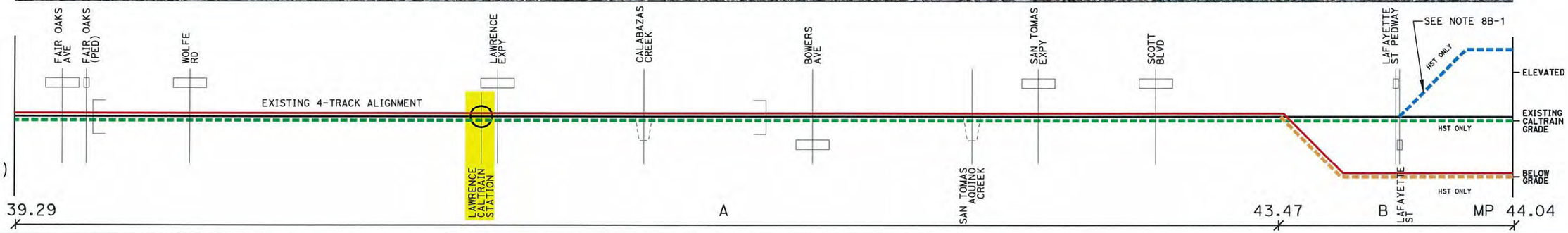
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.9 Subsection 8 – Sunnyvale and Santa Clara

Options Considered

- Subsection 8A – North of Fair Oaks Avenue to South of Scott Boulevard
  - At Grade
- Subsection 8B – South of Scott Boulevard to North of De La Cruz Boulevard
  - Aerial Viaduct (HST Only)
  - At Grade (HST Only)
  - Covered Trench/Tunnel (HST Only)
  - Deep Tunnel (HST Only)

Vertical Profile Feasibility Notes

Note	Issue	Description
8B-1	Adjusted	Unable to start vertical curve after Lafayette Street due to height needed to clear De La Cruz Boulevard.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 8A: At Grade.
- 8B: Aerial Viaduct (HST Only), At Grade (HST Only), Covered Trench/Tunnel (HST Only), Deep Tunnel (HST Only). Under all options, Caltrain would remain at grade in its existing configuration.

Options Not Carried Forward

None.

Table 4-11
Summary Comparison of Design Options for Subsection 8 – Sunnyvale, Santa Clara

Evaluation Measure			8A - North of Fair Oaks Avenue to South of Scott Boulevard	8B - South of Scott Boulevard to North of De La Cruz Boulevard			
			At Grade	Aerial Viaduct (HST Only)	At Grade (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options			
		Route length	Same for all options	Same for all options			
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable			
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Higher than At Grade option, due to aerial structure	Lowest	Higher than Aerial Viaduct option, due to ventilation, life safety, etc	Higher than Aerial Viaduct option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	125 million	40 million	7 million	150 million	113 million
		Acquisition cost of additional ROW	Highest	Medium	Highest	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable			
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies			
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Construction would primarily occur within ultimate ROW	Low; Approximately 85% of existing ROW is over 100’	Low; Construction would primarily occur within ultimate ROW	Low; Approximately 85% of existing ROW is over 100’	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Calstone Lead and Butterhouse Lead connections	Not applicable			
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable	Not applicable			
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96’. Approximately 40% of subsection has existing ROW <90’, 15% between 90’-99’ and 45% over 100’	Low; Approximately 85% of existing ROW is over 100’	Low; Approximately 85% of existing ROW is over 100’	Low; Approximately 85% of existing ROW is over 100’	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None			
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable			

Evaluation Measure			8A - North of Fair Oaks Avenue to South of Scott Boulevard	8B - South of Scott Boulevard to North of De La Cruz Boulevard			
			At Grade	Aerial Viaduct (HST Only)	At Grade (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None	None			
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	0.28	None			
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None			
	Cultural resources	Number of historic structures within ultimate ROW	None	None			
		Archeological Sensitivity (identified as present or not)	Present	Present			
	Parklands	Acres of parklands within ultimate ROW	0.06	None			
	Agricultural lands	Acres of farmland	Not applicable	Not applicable			
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=301-500, I=5-10, S<5, P<5	R=101-200, I<5, S<5	Lower impacts than Aerial Viaduct option	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=301-500, I=5-10, S<5, P<5	Lower impacts than At Grade option	R=61-100, I<5, S<5	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200; P<5	R=41-60	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	
		Number of scenic roadways that cross the ROW	None	5	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	0%	0%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	2/15	2/8	2/8	2/8	Lower impacts than other options, depending on the siting of vent structures, tunnel portals, and tunnel depth

Subsection #9 (a)

Length: 3.5 miles Land Use: Urban

North of De La Cruz Boulevard to San Jose Diridon Station (MP. 44.04 to MP. 47.54)
This subsection is located in the Cities of San Jose and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection,primarily in a tunnel.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

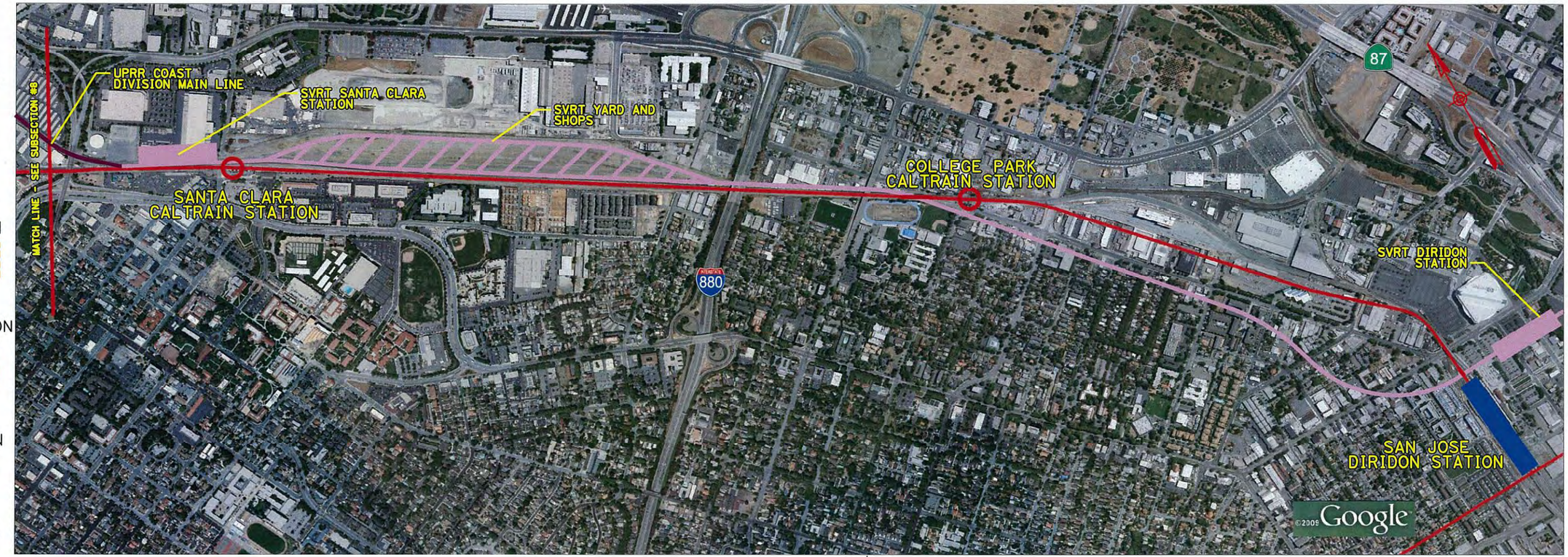
CALTRAIN STATION DESIGN OPTION

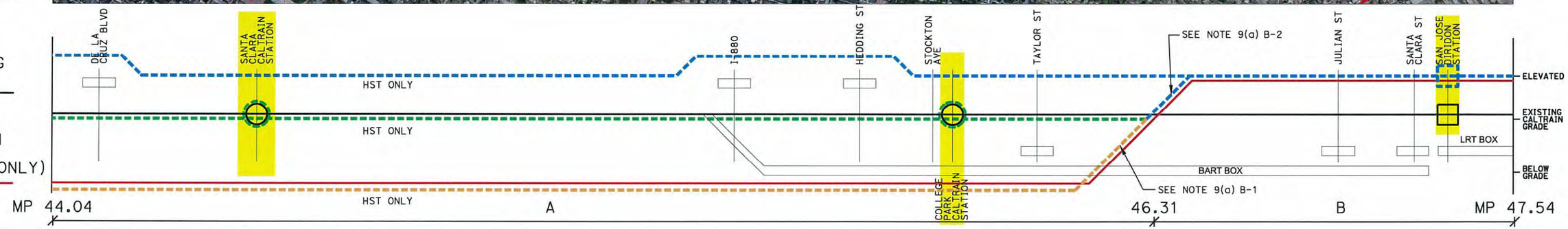
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.10 Subsection 9(a) – San Jose

Options Considered

- Subsection 9(a)A – North of De La Cruz Boulevard to South of Taylor Street
  - Aerial Viaduct (HST only)
  - At Grade (HST only)
  - Covered Trench/Tunnel (HST Only)
  - Deep Tunnel (HST only)
- Subsection 9(a)B – South of Taylor Street to San Jose Diridon station
  - Aerial Viaduct (HST only)

Vertical Profile Feasibility Notes

Note	Issue	Description
9(a)B-1	Adjusted	Unable to start vertical curve after Taylor Street due to BART box and elevation difference to clear Julian Street.
9(a)B-2	Adjusted	Unable to start vertical curve after Taylor Street due to elevation difference to clear Julian Street.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 9(a)A: Aerial Viaduct (HST Only), At Grade (HST Only), Covered Trench/Tunnel (HST Only), Deep Tunnel (HST Only). The At Grade (HST Only), Covered Trench/Tunnel (HST Only) and Deep Tunnel (HST Only) options could result in converting the Hedding Street overpass to an underpass.
- 9(a)B: Aerial Viaduct (HST Only). The HST platforms at San Jose Diridon station would be located above the existing passenger rail platforms.

Options Not Carried Forward

An HST station in Santa Clara was considered and rejected in the Statewide program document.

Table 4-12
Summary Comparison of Design Options for Subsection 9(a) – San Jose

Evaluation Measure			9(a)A - North of De La Cruz Boulevard to South of Taylor Street				9(a)B - South of Taylor Street to Diridon Station
			Aerial Viaduct (HST Only)	At Grade (HST Only)	Covered Trench/ Tunnel (HST Only)	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options				Same for all options
		Route length	Same for all options				Same for all options
	Maximize connectivity and accessibility	Intermodal connections	Not applicable				Same for all options
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Lowest	Higher than Aerial Viaduct option, due to ventilation, life safety, etc	Higher than Aerial Viaduct option, due to ventilation, life safety, etc	Low
		Capital cost ($ 2009), does not include ROW	160 million	54 million	594 million	484 million	248 million
		Acquisition cost of additional ROW	Medium	Highest	Lowest	Lowest	Medium
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable				Same for all options (San Jose Diridon HST station in this subsection)
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies				Consistent with adopted plans and policies
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Medium; Approximately 60% of existing ROW is over 100’	Low; Construction would primarily occur within ultimate ROW	Medium; Approximately 60% of existing ROW is over 100’	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Approximately 85% of existing ROW is over 100’
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable				Not applicable
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable				Not applicable
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Approximately 10% of subsection has existing ROW <90’, 30% is between 90’-99’ and 60% over 100’	Low; Approximately 10% of subsection has existing ROW <90’, 30% is between 90’-99’ and 60% over 100’	Low; Approximately 10% of subsection has existing ROW <90’, 30% is between 90’-99’ and 60% over 100’	Low; Possibly some due to ventilation structures	Low; Approximately 15% of subsection has existing ROW <70’ and 85% is over 100’
	Properties with access affected	Properties with access affected	None				None
	Local traffic effects around station	Increase in traffic congestion	Not applicable				Same for all options
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None				None
Environmental Resources	Waterways and wetlands and natural preserves or biologically	Waterways (acres of waterways within ultimate ROW)	None				0.11

Evaluation Measure			9(a)A - North of De La Cruz Boulevard to South of Taylor Street				9(a)B - South of Taylor Street to Diridon Station
			Aerial Viaduct (HST Only)	At Grade (HST Only)	Covered Trench/ Tunnel (HST Only)	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only)
	sensitive habitat areas affected	Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None				None
	Cultural resources	Number of historic structures within ultimate ROW	3	3	3	Lower impacts than other options, depending on siting of vent structures and tunnel portals	1
		Archeological Sensitivity (identified as present or not)	Present				Present
	Parklands	Acres of parklands within ultimate ROW	None				0.46 (two facilities)
	Agricultural lands	Acres of farmland	Not applicable				Not applicable
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, S<5, P<5	Lower impacts than Aerial Viaduct option	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	R=101-200, I=5-10, P=5-10
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	R=101-200, I<5, S<5	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	R=61-100, I<5, P<5
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=41-60	Lower impacts than Aerial Viaduct option	Minimal impacts	Minimal impacts	R=41-60
		Number of scenic roadways that cross the ROW	None				5
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	0%	1%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	4/26	4/26	4/26	Lower impacts than other options, depending on the siting of vent structures, tunnel portals, and tunnel depth	2/9

Subsection #9 (b)

Length: 3.1 miles Land Use: Urban

North of De La Cruz Boulevard to San Jose Diridon Station (MP. 44.04 to MP. 47.07)
This subsection is located in the Cities of San Jose and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection, primarily in a tunnel. The access alignment to the San Jose Diridon Station (for HST service) is modified to match the alternative downtown alignment being studied by the Mer-SJ HST Team.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

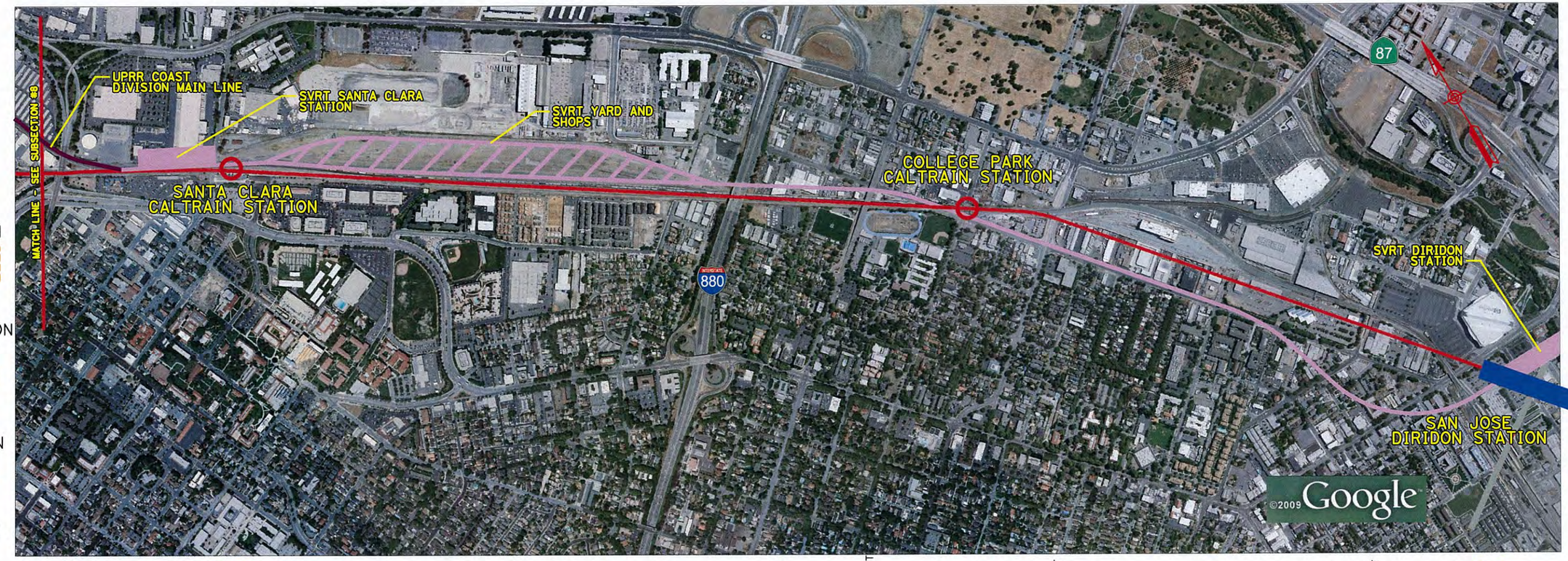
CALTRAIN STATION DESIGN OPTION

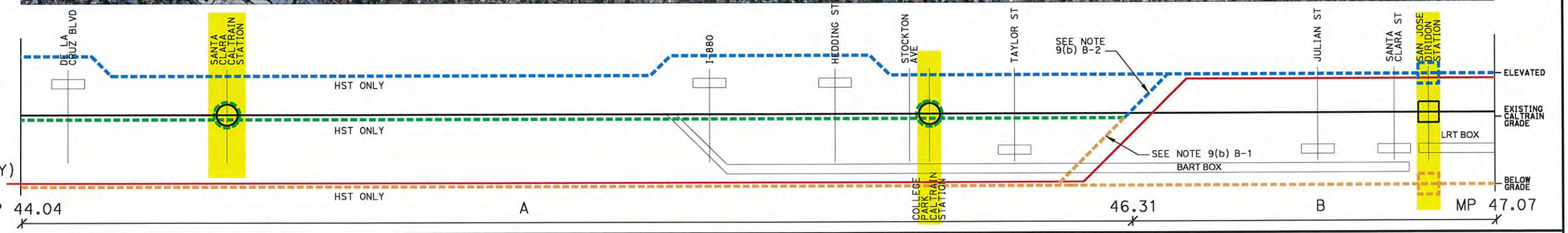
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.11 Subsection 9(b) – San Jose

Options Considered

The Preliminary Alternatives Analysis for San Jose to Merced Section is considering an HST alternative that approaches San Jose Diridon station from the south in a tunnel alignment east of the existing station building. To maintain consistency with the San Jose to Merced Section, Subsection 9(b) has been included in this analysis. Subsection 9(b) will be carried forward in the San Francisco to San Jose Section only if the San Jose to Merced Section alternatives analysis determines that a tunnel alignment east of the existing station building will be carried forward.

- Subsection 9(b)A – North of De La Cruz Boulevard to South of Taylor Street
  - Deep Tunnel (HST only)
- Subsection 9(b)B – South of Taylor Street to San Jose Diridon station
  - Deep Tunnel (HST only)

Vertical Profile Feasibility Notes

Note	Issue	Description
9(b)B-1	Adjusted	Unable to start vertical curve after Taylor due to BART box and elevation difference to clear Julian St.
9(b)B-2	Adjusted	Unable to start vertical curve after Taylor due to elevation difference to clear Julian St.

Options Carried Forward

If a tunnel alignment east of the existing San Jose Diridon station building is carried forward in the San Jose to Merced Section, then the San Francisco to San Jose Section would carry forward the following options:

- 9(b)A: Deep Tunnel (HST Only).
- 9(b)B: Deep Tunnel (HST Only). The HST platforms at San Jose Diridon station would be underground in the area between Cahill Street and Autumn Street.

Options Not Carried Forward

An HST station in Santa Clara was considered and rejected in the Statewide program document.

Table 4-13
Summary Comparison of Design Options for Subsection 9(b) – San Jose

Evaluation Measure			9(b)A – North of De La Cruz Boulevard to South of Taylor Street	9(b)B - South of Taylor Street to Diridon Station
			Deep Tunnel (HST Only)	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options
		Route length	Same for all options	Same for all options
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Same for all options
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Due to tunnel walls, drainage, ventilation, life safety, etc	Due to tunnel walls, drainage, ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	484 million	383 million
		Acquisition cost of additional ROW	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Same for all options (San Jose Diridon HST station in this subsection)
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable	Not applicable
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable	Not applicable
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	Possibly some due to ventilation structures	Possibly some due to ventilation structures
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Same for all options
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None	None
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat	Waterways (acres of waterways within ultimate ROW)	None	None

Evaluation Measure			9(b)A – North of De La Cruz Boulevard to South of Taylor Street	9(b)B - South of Taylor Street to Diridon Station
			Deep Tunnel (HST Only)	Deep Tunnel (HST Only)
	areas affected	Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None
	Cultural resources	Number of historic structures within ultimate ROW	3	None
		Archeological Sensitivity (identified as present or not)	Present	None
	Parklands	Acres of parklands within ultimate ROW	None	None
	Agricultural lands	Acres of farmland	Not applicable	Not applicable
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, S<5, P<5; impacts depend on siting of vent structures and tunnel portals	I=5-10, P<5; impacts depend on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=61-100, I<5, P<5; impacts depend on siting of vent structures and tunnel portals	Low
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=61-100; impacts depend on siting of vent structures and tunnel portals	Minimal impacts
		Number of scenic roadways that cross the ROW	None	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	4/26; impacts depend on siting of vent structures, tunnel portals, and tunnel depth	1/9; impacts depend on siting of vent structures, tunnel portals, and tunnel depth

5.0 Analysis Summary and Conclusions

Subsection 0 – San Francisco:

Only Option 0(a)A, in which HST and Caltrain service is offered at the Transbay and 4th & King locations, has been identified to be carried forward into further engineering and environmental analysis. Option 0(b)A, with which all HST service goes to the Transbay Transit Center and there is no HST service at the 4th & King station, is not practicable and does not meet project purpose and need and objectives due to insufficient capacity. Option 0(c)A, which assumes that all HST service terminates at the 4th & King station, does not satisfy Proposition 1A as HST service would not reach the Transbay terminal as a San Francisco terminus. Option 0(d)A with which HST service would go to a Beale Street station at Transbay Terminal and also to a 4th & King station is not practicable because of difficulties constructing the tunnel along The Embarcadero and under the Bay Bridge and because it would have extensive impacts to properties and displacements.

Subsection 1 – San Francisco: The At Grade and Covered Trench/Tunnel options have been identified to be carried forward into further engineering and environmental analysis. Both options include tunnels parallel to existing Caltrain tunnels 1-4. With the At Grade option, the new tunnels would be at approximately the same depth as the existing tunnels, while under the Covered Trench/Tunnel option the new tunnels would be deeper than the existing tunnels. Under either option, Caltrain and freight would continue to use the existing Caltrain tracks.

Subsection 2 – Brisbane, South San Francisco, San Bruno and Millbrae: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 2A: At Grade.
- 2B: Berm with tracks partially elevated and roadway crossings partially depressed. A fully elevated option is not practical due to the impacts on freight rail connections to South San Francisco Yard and the Granite Rock/Central Concrete tracks.
- 2C: Berm in the segment north of San Felipe Avenue where the San Bruno Grade Separation Project is located; At Grade between San Felipe Avenue and Santa Lucia Avenue; Aerial Viaduct, Berm, Open Trench (HST Only), Covered Trench/Tunnel (HST Only) south of Santa Lucia Avenue.
- 2D: A configuration that leaves the existing tracks at grade and stacks the new tracks and the HST station below the existing tracks in Open Trench or Covered Trench/Tunnel. This configuration would avoid right-of-way impacts at the Millbrae station where there are local plans for a transit-oriented development.

Subsection 3 – Burlingame and San Mateo: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 3A: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel.
- 3B-3D: Aerial Viaduct, Open Trench, Covered Trench/Tunnel. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option. The At Grade option was not carried forward in Subsection 3B because it would have extensive impacts to properties and displacements.
- 3E: At Grade.

Subsection 4 – San Mateo, Belmont, San Carlos, and Redwood City: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 4A: Berm with the tracks partially elevated and 25th Avenue partially depressed. The At Grade option is not practical due to the short transition distance between 25th Avenue and 28th Avenue.
- 4B: Aerial Viaduct and Berm in the segment between Highway 92 and 42nd Avenue to accommodate local plans for transit-oriented development calling for 28th Avenue and 31st Avenue to extend across the Caltrain corridor, and for potential relocation of the Hillsdale Caltrain station approximately ¼ mile north of its present location. Aerial Viaduct, Berm, At Grade, Covered Trench/Tunnel, and Deep Tunnel (HST Only) in the segment between 42nd Avenue and Cordilleras Creek.
- 4C: Aerial Viaduct, Open Trench, Covered Trench/Tunnel, Deep Tunnel (HST Only).
- 4D: Aerial Viaduct (HST Only), At Grade (Caltrain Only), Open Trench (HST Only), Covered Trench/Tunnel (HST Only), Deep Tunnel (HST Only). Caltrain would follow the At Grade option to allow for a Caltrain and freight connection to the Dumbarton branch and Port of Redwood City spur. HST would follow either the Aerial Viaduct, Open Trench, Covered Trench/Tunnel or Deep Tunnel options. The Aerial Viaduct (HST Only) option requires converting the Woodside Road overpass to an underpass. The Woodside Road overpass would be unchanged under the Open Trench, Covered Trench/Tunnel and Deep Tunnel options.

Subsection 5 – Atherton and Menlo Park: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 5A: At Grade, Deep Tunnel (HST Only).
- 5B: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel, Deep Tunnel (HST Only). The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option.
- 5C: At Grade, Covered Trench/Tunnel, Deep Tunnel (HST Only). The Open Trench option would have substantial impacts on San Francisquito Creek and the El Palo Alto tree.

Subsection 6 – Palo Alto: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 6A: At Grade, Covered Trench/Tunnel, Deep Tunnel (HST Only). The Aerial Viaduct and Open Trench options would have substantial impacts on the existing El Palo Alto tree, San Francisquito Creek, and the historic Palo Alto Caltrain station. The Berm option does not enhance connectivity and mobility as well as a trench or tunnel option.
- 6B: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel, Deep Tunnel (HST Only). The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option. The Aerial Viaduct, At Grade, and Open Trench options may result in the loss of two traffic lanes on Alma Street. A stacked configuration (2 tracks over 2 tracks) could minimize right-of-way requirements.
- 6C: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel, Deep Tunnel (HST Only). The Aerial Viaduct, At Grade, and Open Trench options may result in the loss of one to two traffic lanes on Alma Street. A stacked configuration (2 tracks over 2 tracks) could minimize right-of-way requirements.

- 6D: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel, Deep Tunnel (HST Only). The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option.

Subsection 7 – Mountain View and Sunnyvale: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 7A-7B: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option. The Aerial Viaduct, At Grade, and Open Trench options may result in the loss of two traffic lanes on Central Expressway north of Rengstorff Avenue. A stacked configuration (2 tracks over 2 tracks) could minimize right-of-way requirements and possible relocation of the VTA LRT. The Aerial Viaduct option requires converting the San Antonio Road and Shoreline Boulevard overpasses to at grade configurations.
- 7C-7D: Aerial Viaduct, At Grade, Open Trench, Covered Trench/Tunnel. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option. The Aerial Viaduct, At Grade, and Open Trench options may result in loss of one to two traffic lanes on Central Expressway or Evelyn Avenue. A stacked configuration (2 tracks over 2 tracks) could minimize right-of-way requirements.

Subsection 8 – Sunnyvale and Santa Clara: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 8A: At Grade.
- 8B: Aerial Viaduct (HST Only), At Grade (HST Only), Covered Trench/Tunnel (HST Only), Deep Tunnel (HST Only). Under all options, Caltrain would remain at grade in its existing configuration.

Subsection 9(a) – Santa Clara and San Jose: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 9(a)A: Aerial Viaduct (HST Only), At Grade (HST Only), Covered Trench/Tunnel (HST Only), Deep Tunnel (HST Only). The At Grade (HST Only), Covered Trench/Tunnel (HST Only) and Deep Tunnel (HST Only) options could result in converting the Hedding Street overpass to an underpass.
- 9(a)B: Aerial Viaduct (HST Only). T he HST platforms at San Jose Diridon station would be located above the existing passenger rail platforms.

Subsection 9(b) – Santa Clara and San Jose: The Preliminary Alternatives Analysis for San Jose to Merced Section is considering an HST alternative that approaches San Jose Diridon station from the south in a tunnel alignment east of the existing station building. To maintain consistency with the San Jose to Merced Section, Subsection 9(b) has been included in this analysis. Subsection 9(b) will be carried forward into further engineering and environmental analysis in the San Francisco to San Jose Section only if the San Jose to Merced Section alternatives analysis determines that a tunnel alignment east of the existing station building will be carried forward.

If a tunnel alignment east of the existing San Jose Diridon station building is carried forward in the San Jose to Merced Section, then the San Francisco to San Jose Section would carry forward the following options:

- 9(b)A: Deep Tunnel (HST Only).
- 9(b)B: Deep Tunnel (HST Only). The HST platforms at San Jose Diridon station would be underground in the area between Cahill Street and Autumn Street.

Alternatives to be Carried Forward for Further Engineering and Environmental Analysis

Table 5-1 presents the alternatives preliminarily identified to be carried forward for further engineering and environmental analysis, which are also summarized in Figure 5-1. Additional outreach will occur as these preliminary recommendations are finalized and carried forward into further environmental and engineering analysis.

Table 5-1
Alternatives Carried Forward

Sub-section	Location	Alternatives Carried Forward					
		Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel
0(a)	HST and Caltrain to both Transbay and 4th & King					✓	
0(b)	HST and Caltrain to Transbay, Caltrain to 4th & King						
0(c)	HST to 4th & King, Caltrain to Transbay and 4th & King						
0(d)	HST and Caltrain to both Beale Street and 4th & King						
1A	North of Mission Bay Drive to South of 16th Street			✓		✓	
1B-1C	South of 16th Street to North of Cesar Chavez Street			✓		✓	
1D-1G	North of Cesar Chavez Street to South Portal Tunnel No. 4			✓		✓	
2A	South Portal Tunnel No. 4 to south of Colma Creek			✓			
2B	South of Colma Creek to south of I-380		✓				
2C	South of I-380 to south of Center Street	✓	✓	✓	HST Only	HST Only	
2D	South of Center Street to south of Millbrae Avenue			✓	HST Only	HST Only	
3A	South of Millbrae Avenue to south of Mills Creek	✓		✓	✓	✓	
3B	South of Mills Creek to north of Villa Terrace	✓			✓	✓	

Sub-section	Location	Alternatives Carried Forward					
		Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel
3C-3D	North of Villa Terrace to north of Hayward Park Station	✓			✓	✓	
3E	North of Hayward Park Station to north of Highway 92			✓			
4A	North of Highway 92 to south of 25th Avenue		✓				
4B	South of 25th Avenue to south of Cordilleras Creek	✓	✓	✓		✓	HST Only
4C	South of Cordilleras Creek to north of Woodside Road	✓			✓	✓	HST Only
4D	North of Woodside Road to north of 5th Avenue	HST Only		Caltrain Only	HST Only	HST Only	HST Only
5A	North of 5th Avenue to south of 5th Avenue			✓			HST Only
5B	South of 5th Avenue to south of Ravenswood Avenue	✓		✓	✓	✓	HST Only
5C	South of Ravenswood Avenue to north of San Mateo County/Santa Clara County Line			✓		✓	HST Only
6A	North of San Mateo County/Santa Clara County Line to south of Embarcadero Road			✓		✓	HST Only
6B	South of Embarcadero Road to south of Churchill Avenue	✓		✓	✓	✓	HST Only
6C	South of Churchill Avenue to north of East Meadow Drive	✓		✓	✓	✓	HST Only
6D	North of East Meadow Drive to north of Adobe Creek	✓		✓	✓	✓	HST Only
7A-7B	North of Adobe Creek to north of Stevens Creek	✓		✓	✓	✓	
7C-7D	North of Stevens Creek to north of Fair Oaks Avenue	✓		✓	✓	✓	
8A	North of Fair Oaks Avenue to south of Scott Boulevard			✓			
8B	South of Scott Boulevard to north of De La Cruz Boulevard	HST Only		HST Only		HST Only	HST Only
9(a)A	North of De La Cruz Boulevard to South of Taylor Street	HST Only		HST Only		HST Only	HST Only
9(a)B	South of Taylor Street to Diridon Station	HST Only					
9(b)A	North of De La Cruz Boulevard to South of Taylor Street						HST Only
9(b)B	South Taylor Street to Diridon Station						HST Only

Conclusions

The Preliminary Alternatives Analysis report and its associated engineering and environmental analysis confirms that a four track, grade separated, shared Caltrain and HST system is feasible and the preferred HST alternative between San Francisco and San Jose on the Peninsula. It also confirms that such a system between San Francisco and San Jose can be built at costs that are in the range of what has been presented in the 2009 Business Plan and in previous program-level environmental documents.

Since 1996, the Peninsula Corridor Joint Powers Board (Caltrain) has endorsed HST in concept and has adopted multiple resolutions expressing such support. Since 2004, the Authority and Caltrain have worked in a partnership to develop the Caltrain corridor into a 21st century railroad capable of serving both commuter and HST for the Peninsula and California. This partnership is founded on the basis that there are considerable efficiencies and synergies between the two rail services. This alignment alternative would increase intercity connectivity and accessibility to San Francisco, the Peninsula, and SFO, while improving the safety, reliability, and performance of the regional Caltrain commuter service. The Caltrain corridor shared-use option would take advantage of the existing rail infrastructure and would maximize the opportunity to provide rail service at-grade where possible. Environmental impacts would be minimized since this alignment utilizes the existing Caltrain right-of-way. In addition, the Caltrain shared use corridor would provide safety and traffic benefits by grade-separating existing at-grade roadway crossings. For these reasons, the Caltrain shared use corridor is the preferred alignment for HST service between San Francisco and San Jose.

The entire alignment will be a predominantly four track, grade separated railroad and would allow both Caltrain and HST to operate their respective services. It would be a shared track system with HST operating at speeds up to 125 mph and Caltrain up to 110 mph.

The HST stations recommended for continued study are:

Downtown San Francisco: A joint terminal solution for downtown San Francisco at the Transbay Transit Center and 4th and King.

San Francisco Airport Connector Station: Millbrae (SFO).

A Potential Mid-Peninsula Station: Redwood City, Palo Alto and Mountain View Caltrain stations are currently under consideration. One or none of these potential station locations could be selected to be part of the HST system.

Downtown San Jose Terminus: Diridon Station.

The Authority, the FRA and Caltrain, in addition to performing engineering and environmental analysis, have engaged the public and the communities on the Peninsula and are incorporating their input from San Francisco to San Jose. The observations below outline some of the highlights from the work and input received to-date:

- In San Francisco the analysis supports focusing Authority, FRA and Caltrain engineering and study efforts on a joint terminal solution for downtown San Francisco at the Transbay Transit Center and 4th and King. This is consistent with the City and County of San Francisco's and the Transbay Joint Powers Authority's plans and policies, and is a workable solution for the HST and Caltrain services.
- On the Peninsula, the Authority, FRA and Caltrain will limit the use of high berms in commercial or residential areas where they would significantly reduce connectivity and mobility or where there is strong local opposition to this type of structure.
- Tunnel options for Caltrain, HST or both have been added for further evaluation in sections throughout the corridor. This was, in some cases, in direct response to suggestions from local communities.
- At the request of the City of Mountain View, the Authority is considering the current Caltrain Mountain View station as an additional potential HST station.

It is important to understand that while some subsections carry multiple design options it is not always possible to connect two vertical options from one subsection to another (tunnel to aerial viaduct for example). In some cases communities on the corridor will need to "share" an alternative. The transitions from one vertical solution to another takes approximately 3,000 feet or just over half a mile, so "quick" adjustments between vertical alternatives are not possible. These types of engineering realities will necessitate close cooperation between neighboring cities and communities, Caltrain and the Authority in developing appropriate solutions in these subsections and throughout the corridor.

Given the highly developed nature of the Caltrain corridor, the Authority, FRA and Caltrain have carried a wide range of vertical design options, where practical, from San Francisco to San Jose. No design options on the Caltrain corridor were eliminated from further consideration due to cost alone. This was in part because many individuals and communities on the corridor expressed a strong desire that alternatives be carried forward until there was a thorough analysis and discussion of the costs, environmental impacts, and engineering issues of the various vertical options. The other primary reason is that in order to develop an appropriate and logical cost estimate, all of the 10 subsections of the Caltrain corridor need to be "stitched" together into a cohesive system from San Francisco to San Jose. This exercise will be part of the 15% design study which is currently underway. Context Sensitive Solutions will also be incorporated in this effort. Once these corridor-wide alternatives are developed, they will be described on an engineering, environmental and cost basis. These corridor-wide alternatives can then become the basis for discussion of cost sharing between the Authority, FRA and other agencies including cities on the corridor.

The Preliminary Alternatives Analysis report shows that if alternatives from San Francisco to San Jose were created from the most costly design options put together, the costs could be between four to five times what has been accounted for in the Business Plan or other previous estimates. Such high cost alternatives would be impracticable.

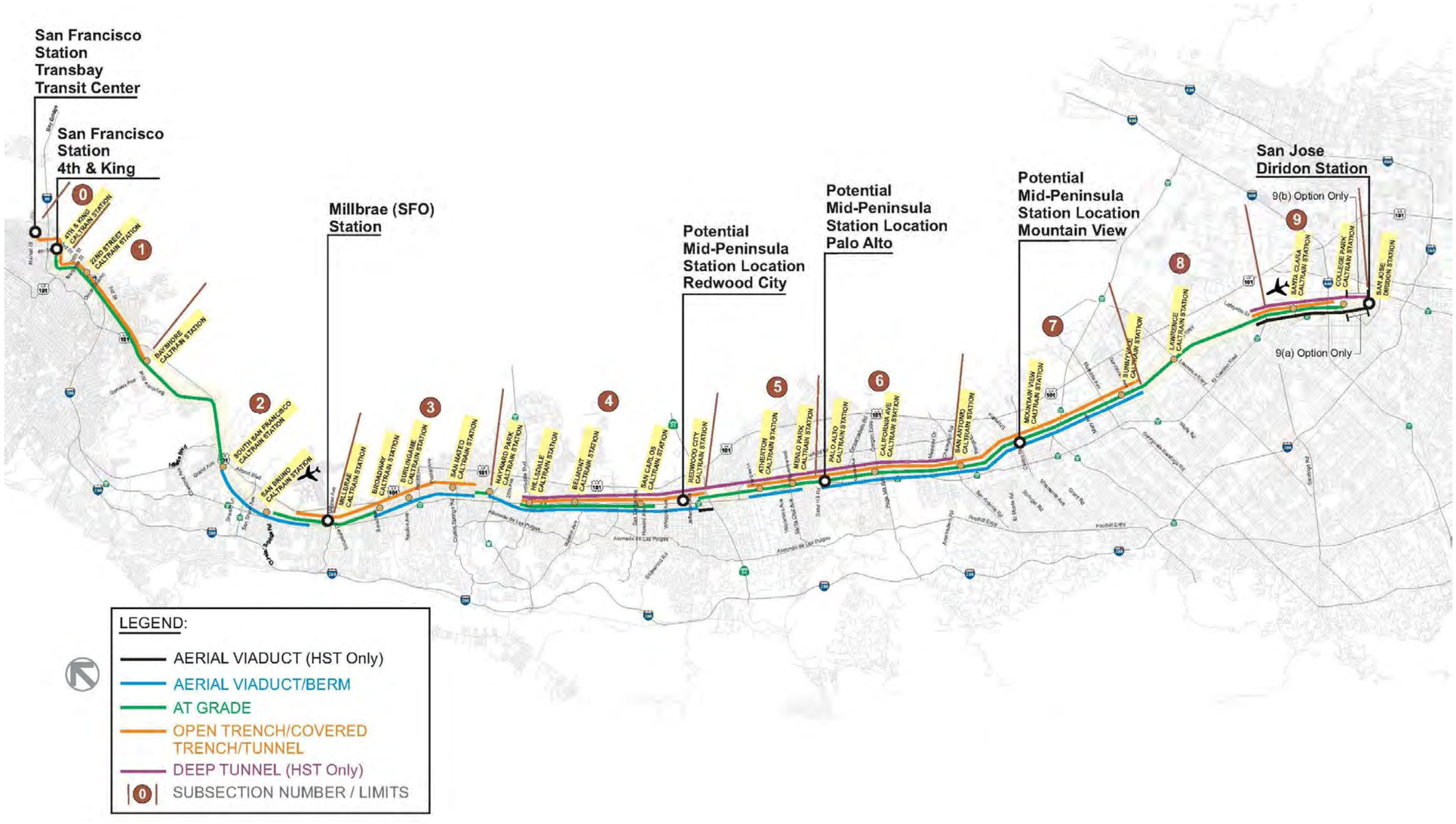
Next Steps

This Alternatives Analysis report informs the Project Description for the EIR/EIS. It also sets parameters for the next level of design (15%) and environmental analysis. This on-going work will provide the Authority, FRA, Caltrain and the communities on the corridor more details of both the design options in each subsection and a comprehensive vision of the entire corridor.

Detailed operations studies will be performed for combining the Caltrain and HST scheduled operations for the corridor so that the design and the phasing of the construction of the project will inform the feasibility of the various vertical alternatives.

As the engineering and environmental work continues, the Authority and Caltrain will continue to meet and engage the cities on the corridor in a discussion about the various alternatives. If deemed necessary by the lead agencies, a supplemental Alternative Analysis report will consider feedback received on this Preliminary Alternative Analysis report and will discuss how the alternatives analysis will inform the detailed engineering, environmental and outreach activities on the Caltrain corridor. These activities will inform preparation of the draft EIR/EIS, which is currently scheduled for public comment in December of 2010.

Figure 5-1
Vertical Options Carried Forward



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